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International Leadership in Ferrous Research

Being heartily tired of refuting the notion that Germany is the home of science; that Germany is ahead of us in metallurgical research, and similar statements, it naturally gives us a good deal of pleasure to publish an official Report to the [American] National Resources Planning Bureau, which, so far as ferrous metallurgy is concerned, gives the lie direct. This Report, submitted by the National Research Council, has been prepared by Mr. Frank T. Sisco, and this is highly significant, for it would be difficult to find any metallurgist better qualified to undertake such a task. We base this statement on the fact that during the last decade Mr. Sisco has been engaged upon the editing of a series of fifteen monumental works, which have received nothing less than complete approbation throughout the metallurgical world. These books embrace all the accumulated knowledge published up to the time of going to press of iron alloyed with a number of important elements. The very complete research through the literature of the world undertaken by Sisco and his colleagues forms the best possible background for the assessment of the worth and novelty of the inventions relating to processes and materials relating to ferrous metallurgy. Statistically up to 1900 Britain is credited with 40 per cent. of research output, but we attach more importance to the sentence: "The industrial world owes a large debt to the inventive and scientific genius of some 10 or 15 Englishmen who in the last half of the nineteenth century revolutionised the steel industry and in addition founded the science of physical metallurgy." The names picked out by the author are: Bessemer; Mushet; Siemens; Thomas and Gilchrist; Hadfield; Sorby; Barrett; Arnold; Percy, and Bell. We were pleased to see that the work of Taylor and White in connection with the discovery of high-speed steel is recognised, for though Sheffield interests contested the validity of the Patent, as the Americans did with those of Bessemer, there was and is a recognition in both cases as to the merit of the true invention by the metallurgists referred to.

Naturally enough, the foregoing would not satisfy those steeped in the belief of the supremacy of German metallurgical research, for they would retort that what has happened was the obvious result of Britain's earlier industrialisation than other steel making countries. The Report by Sisco, however, provides ample evidence to the contrary, for he has analysed the whole of the research work done during the first three decades of this century, and his table [II] shows that the British output compares very favourably with that of Germany. Moreover, neither boom nor depression has any great influence on the output of research.

The most important part of the Report as related to present conditions is that portion devoted to a study of the volume and nature of the research work now in progress in the States. There is an annual expenditure of more than two million pounds on research work, which effort requires the full attention of 2,350 technicians, aided by a further 1,200 part-time workers. The future for metallurgy is being well catered for, whilst in 1934 there were 937 students taking degree courses, the figure increased to 1,630 in 1937. So far as co-operative research is concerned, bouquets are handed out to both this country and Germany, yet we are not at all sure that the posies gathered in America in recent years do not make a better showing. The Americans have produced the fifteen monographs, referred to earlier, at a cost of over £5,000 a year for the last twelve years, the publication of which must already have prevented large sums of money being wasted in doing unnecessary jobs twice over, whilst at the same time indicating the gaps badly needing attention. Their technical institutes—and amongst these the American Foundrymen's Association ranks high—have co-operatively added much to the sum total of metallurgical knowledge. In his conclusions, Sisco outlines the economic significance of research in the American steel industry, and to our mind he has not done justice to his subject. Perhaps we at a distance get a better perspective, but in our judgment we should have stressed that research has enabled the Americans to make the *cleanest of clean steels.* The importance of this cannot be overstressed.

Finally, the above gives solid ground for hope that, so far as ferrous metallurgical research is concerned, we have now heard the last of the vaunted superiority of German science. The Germans at least should be convinced since, probably for the first time in history, the matter has been examined statistically, and judgment has been given by the one authority best qualified to give a fair verdict.

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Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Plaster Patterns

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I have read with much interest your account of the Paper "Plaster Patterns for Foundry Use," presented to the Wales and Monmouth Branch of the I.B.F. by Mr. Henry Plucknett.

It is indeed a pleasure to read a Paper dealing with a branch of patternmaking which holds great possibilities, but, nevertheless, is sadly neglected, and I congratulate the author of the Paper on a worthy effort to place this branch of the trade in its rightful place.

I would like to comment, however, on the remarks the author makes regarding the methods of constructing a wood pattern for a 20 in. dia. cylinder, 2 in. thick walls, 9 in. high. Whilst generally agreeing with Mr. Plucknett regarding the fact that time can be saved in making the pattern in plaster, I feel that the method he outlines for the making of a wood pattern is not the quickest possible method, for a pattern from which I assume only one casting would be required.

Thus the method he suggests for cutting each segment is not usually the practice adopted by the patternmaker. Whereas the author states that a piece of timber 10½ in. square is required for each segment, the method normally adopted, namely, each segment is marked out from a template (this being a thin piece of timber about ¼ in. thick cut to the shape of the segment required, allowances being made for turning and finishing), would only require a piece of timber 10½ in. long by 3½ in. wide. If the timber for such segments be prepared in suitable lengths, the segments can be marked out from the template in such a manner as to reduce waste timber to a minimum.

Regarding the number of segments required to build the pattern in question, six segments to the row as stated is quite in order, but for a one-off job there seems little point in building up nine rows. It is well known that the depth of a segment should not exceed its finished width. The author's segments obey this rule, but, on the other hand, there is no reason why they should not be made thicker, thereby reducing the number of rows.

Personally, I have found it to be good practice to limit the thickness of segments to three-fourths of their finished width, and I have found this to give good results.

To return to the preparation of timber for segments, it is very likely that a 3-in. deal of timber would be sawn down for this job and each board planed to the maximum thickness, probably 1⅞ in. This would economise in timber, as there would be no unnecessary waste in cutting and thicknessing. Forty-two segments would be cut from timber of this thickness, and this would reduce the number of rows to seven. With care in trueing up the faces of the segments, this would leave sufficient to true up the depth when the whole job was glued up and in the lathe. Such a job as the one in question would most probably be built up in the lathe, being glued and screwed together, and, although from the point of view of good patternmaking it is definitely bad practice, it would no doubt be turned up before the glue was properly set, so that it could be sent in the foundry at the earliest possible moment.

The method of construction I have outlined would serve the purpose required of such a pattern, and could be completed in a comparatively short time.—Yours, etc.,

W. WEARING, JUN.

24, Dorset Road,
Darlaston, South Staffs.
January 22, 1942.

Some Jobbing Foundry Experiences—XXXII

By "TRAMP"

Light belt-pulleys of cast iron are not in so great demand as formerly but jobbing shops are occasionally called upon to supply odd sizes. Unfortunately the sizes vary considerably in diameter and width of face, while the centre bore and size of boss are very rarely alike. A method whereby occasional pulleys can be produced cheaply is to make a ring of suitable diameter and thickness but of average depth, and a number of sets of arms and bosses together with a couple of templates, the use of which will be clear from the following. Fig. 1 shows two pulleys of 15 in. dia., which are urgently required; one is of 6-in. face and four arms, the other 10-in. face and six arms, with different bosses. In Fig. 2, A is a bottom moulding box, B a ring of 8-in. depth, C a template, to bring the amount of ring in the

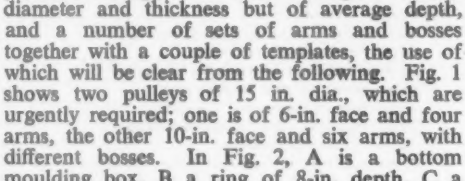


FIG 1.

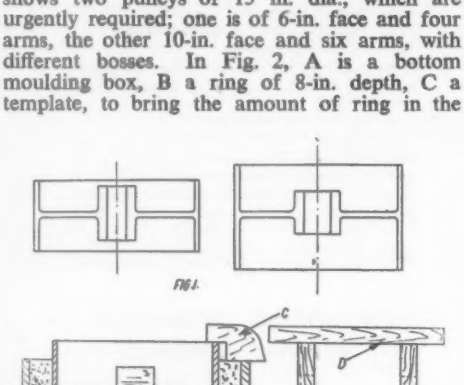


FIG 2.

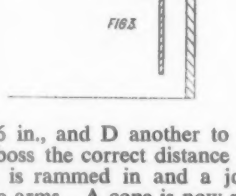


FIG 3.

box 6 in., and D another to position the arms and boss the correct distance down in the ring. Sand is rammed in and a joint made on top of the arms. A cope is now rammed and lifted, the cavity formed by the portion of the pattern projecting into the top is filled in, the pattern withdrawn and the mould made ready for casting. For the second pulley, the same ring can be used, but in this case it is kept down from the joint 2 in., by a gauge as Fig. 3, and the bottom rammed, the arms and boss being positioned by a template as D, Fig. 2. The ring is then "drawn through" to the joint and the top rammed, lifted off and pattern withdrawn. Thus both pulleys can be produced with the minimum of patternwork and far quicker than by endeavouring to alter a "standard pattern."

Book Review

Transactions of the Institution of Chemical Engineers, Vol. 18, 1940.

From the metallurgical angle, this particular volume is a rather poor vintage, but that is not to say that its intrinsic value to the chemical engineer is any the less—indeed, it may be more valuable. There are Papers on "Sedimentation and Flocculation"; "Evaporation of Water from Saturated Surfaces"; and "The Flow of Liquids and Gases," supplemented by a discussion on "The Salvage of Waste Materials in the Chemical Industry," all of which have a remote bearing on various phases of foundry practice.

Random Shots

The recent publicity given to the "mislaying" of a truckload of cheques from a bank clearing house only serves to illustrate how much salvage comes from an accumulation of even very small pieces of paper. If one does not take into consideration the writing on it, a cheque seems such an inconsequential scrap of paper that it is hard to imagine how it could possibly help the war effort. Yet a truckload assumes such proportions that it is easy to rate its value as salvage. In fact, one could imagine a new type of thief (the paper snatcher as opposed to the body snatcher of former times) specially employed by salvage officials to watch that bank clearing house and foully to steal, at dead of night, each consignment that leaves its doors to deliver it up to the pulping machines before it becomes dispersed once again amongst the private clients of the banks. For once that happens, a cheque is apparently lost for ever to the salvage effort. It is then that the writing on it assumes a higher importance than the paper itself. The original sender gets it back and is either so overcome with surprise that so large a sum has been honoured by his bank that he pigeon-holes it with all due reverence; or else he is a man so well trained in the value of documentary proof that nothing can persuade him to put it in the W.P.B. It is quite certain, then, that thousands of people must have hundreds of "dead" cheques carefully stowed away, either divided by rubber bands into respective years or grouped according to "gas," "electricity," "rent," "tailor," etc.; for it is a tradition to keep all such records for at least seven years. Now is the time to forsake the old traditions and, showing oneself capable of rising to an occasion, thrust away all but the most recent. So will there be not one truckload but many for the salvage effort, and the Controller need not toy with the tempting scheme of snatching them away whilst they are so conveniently housed communally.

* * *

Although the dampness of the English climate causes people to experience many a twinge of rheumatics in the winter, the good old-fashioned complaint of gout (usually caused by dining and wining too well) seems to be dying out; and a good thing too if sufferers from this complaint were to depend on a remedy warmly recommended by a sixteenth-century nobleman. He found much virtue in the use of *oil of stagsblood*, which, he says, did speedily ease a sharp attack in the joint of his great toe. "Some offence there is in the smell thereof," he writes, "and yet it is written of it that the very smell thereof is comfortable and yieldeth strength to the brain." So be there any such man still in a position to sup sufficient port to give him gout in the big toe, oil of stagsblood is the thing. Let him remember, however, that whilst the evil smell thereof might yield strength to the brain, it is just as likely to give such offence to the rest of the family that they might feel disposed to counteract that good effect by "dotting you one."

* * *

The question has often been asked as to how the hundreds of milk bars which sprang into being so rapidly just before the war are managing to pay their way since the milk shortage. Perhaps the solution suggests itself in the report that a man was recently fined five shillings for being found lying helplessly drunk on the pavement just outside a milk bar!

* * *

"I don't see anything funny in that," said the youngster when the family laughed at the idea of anyone being found incapable outside a milk bar. "Perhaps he got drunk on milk stout."

"MARKSMAN."

Research in the Iron and Steel Industry*

ANALYSED AS A NATIONAL INDUSTRIAL RESOURCE OVER THE LAST CENTURY

By FRANK T. SISCO,
Metallurgist and Editor, Alloys and Iron Research, N.Y.

Research, as carried out in the iron and steel industry, may be divided into two general classes, *viz.*, process and materials research, and fundamental research. Process and materials research is naturally the most important and widely practised and has a fourfold purpose: (1) Improving quality; (2) improving methods of manufacture and reducing cost; (3) developing new products; and (4) developing new uses and new markets for old products.

Fundamental research in the iron and steel industry seeks to discover the underlying causes of metallurgical phenomena; its primary aim is to add to metallurgical knowledge, and it is usually carried out in the universities and technical schools, in co-operative research institutes, or in Government laboratories; only a relatively small part has been done in steelworks laboratories. On the other hand, most of the process and materials research is carried out by the steel industry, although the staffs of most universities and research institutes direct more effort to ferrous materials and processes than to the fundamentals of metallurgy.

Most of the great developments in the iron and steel industry occurred in the last half of the nineteenth century. As shown in Table I, nearly 40 per cent. of these originated in England where the Industrial Revolution had been under way for nearly a century, far longer than in any other part of the world. Of the other countries which are now leaders in iron and steel production, the United States, Germany and France each contributed about 20 per cent. to the advance of the industry, although, as Table I indicates, the United States was far behind France and Germany (at the time more advanced in industrial policy) in contributions to a fundamental knowledge of metallurgy.

TABLE I.—*Advances in the Iron and Steel Industry, 1850 to 1900.**

Country.	Number of contributions to:		Total.
	Improvement in processes and products.	Fundamental metallurgical knowledge.	
Great Britain ..	23	25	48
United States	20	3	23
Germany ..	14	10	24
France ..	9	14	23
Sweden ..	1	6	7
Total ..	67	58	125

* Data based on Goodale, S. L.: Chronology of Iron and Steel. Pittsburgh Iron and Steel Foundries Co. 1st ed., 1920.

Contributions of Great Britain in the Nineteenth Century

The industrial world owes a large debt to the inventive and scientific genius of some 10 or 15 Englishmen who in the last half of the nineteenth century revolutionised the steel industry and in addition founded the science of physical metallurgy. The Bessemer process of refining pig-iron by blowing air through the molten metal was invented in 1856 by Henry Bessemer and was made a commercial success by the metallurgical genius of Robert Mushet.† This process made it possible for the first time to produce steel cheaply and in large tonnages and was the most important single factor in the development of our present-day industrial economy, which is built upon cheap steel.

Other outstanding developments of processes in England during this period were Siemens' discovery of the regenerative principle which resulted in the open-hearth process, the hot-blast stove for the blast furnace, the reversing mill, the continuous rod mill, and perhaps most important—the discovery by Thomas and Gilchrist that lime removes phosphorus from molten high-carbon iron, thus making it possible to use the enormous world deposits of iron ore containing a relatively large amount of this element.

Great Britain's contributions to the development of ferrous materials were numerous. The most outstanding were Mushet's air-hardening tool steel and Hadfield's extensive work on alloys of iron with manganese, chromium and other elements which played an important part in the development of knowledge that has led to present-day alloy steels. During this period, several Englishmen were engaged in fundamental research on iron and steel. Sorby was the first to use the microscope for the study of the structure of metals, which was the beginning of a science of physical metallurgy. Barrett discovered recalescence and its relation to the hardening of steel, and Arnold did pioneering work in correlating the chemical composition and the properties of ferrous materials. Valuable text books were written by Percy, on the metallurgy of iron and steel (1864), and by Bell, on the chemistry of the blast furnace (1872); these had marked influence on the iron and steel industry everywhere.

Contributions of the United States in the Nineteenth Century

The iron and steel industry of the United States, using the developments outlined above, grew from adolescence to manhood in the last three decades of the nineteenth century. During this period pig-iron production increased from 2 to 14 million tons, and steel production from less than 100,000 tons to 10.5 million tons. The most important cause of this rapid expansion was the building of the railways; miles of track increased from 50,000 in 1870, most of which was laid with iron rails, to 260,000 in 1900, nearly all of which was laid with steel rails. With the introduction of the Bessemer process other uses of steel expanded rapidly, especially for bridges and buildings, and for agricultural purposes. Four thousand million dollars were spent in fencing the farms of the United States during this 30-year period; at least 75 per cent. of this sum was represented by purchases of iron and steel products.

Between 1870 and 1900 the steel industry of the United States was so busy building up the country that there was little time, and less incentive, for research even in the broadest sense of the word. Most development work had as its primary object the reduction of cost; this was so successful that in the last decade of the century the steel industry of the United States was underselling the British in world markets, with the result that the Britsh Iron and Steel Institute sent a delegation to the United States to see how it was done.

Among the developments which were important in lowering costs were more efficient blowing engines for blast furnaces, many improvements in rolling mills, most of which came from the fertile brain of John Fritz, and—most important—the development of efficient machinery for large-scale production of barbed wire, fences, nails and springs. Although the United States did not pioneer the use of steel for building and bridge construction, the skyscraper and the long suspension bridge are American developments.

Only one noteworthy development in steels originated in the United States during the last half of the nineteenth century, but this probably had as important ramifications in industry generally as any that ferrous metallurgy has known. This was the discovery by Taylor and White, in 1894 to 1898, of high-speed steel and of the heat treatment necessary to give the steel its unique property of red hardness, *i.e.*, the ability to keep its cutting edge when operating at such high speeds that the tool gets red-hot. The steel itself was an outgrowth of the original Mushet air-hardening process, but the heat treatment was unique. High-speed steel completely revolutionised the machine-tool industry and made tungsten, its principal alloying element, a strategic material of first importance.

Little research on metallurgical fundamentals was carried out in the United States before 1900. Albert Sauveur was the first in that country to study the structure of steel with the microscope (1891-93), and Henry Marion Howe, at Columbia University, won world-wide fame as an investigator of the constitution of iron-carbon and other alloys. Howe's book on metallurgy, published in 1890, was for many years a classic in this field.

Contributions of Other Countries in the Nineteenth Century

As pioneers in metallurgical research both Germany and France rank as high as the United States. In one sense they rank higher, as Germany was producing only 10 to 17 million tons of steel and pig-iron, and France only 5 to 7 million tons, as compared with an annual total of 18 to 25 million tons for the United States.

Research in France during the last half of the nineteenth century resulted in a number of important developments in processes. French engineers discovered how to coke bituminous coal in closed retorts, so that the valuable by-products could be recovered, and perfected the electric arc furnace as a means of melting steel and non-ferrous alloys. They were also the first to build armoured naval vessels and to use steel in building construction. As the result of research on materials, French scientists were the first to produce ferro-manganese on a commercial scale, and were primarily responsible for the discovery of iron-nickel alloys having unique expansion, magnetic and electric characteristics, which have been an important factor in the development of an efficient communications system. In research in fundamentals, the French rank next to the British. Osmond discovered the allotropy of iron, and Le Chatelier perfected the pyrometer and the metallurgical microscope; these were of prime importance in the development of a science of physical metallurgy.

Of the 24 important contributions made by Germans to the improvement of processes and products, and to furthering metallurgical knowledge, the following are outstanding:—The universal mill, the hydraulic forging press, producing cement from slag, and acetylene, which is now used widely in welding. Martens and Wedding made important contributions to physical metallurgy. Equally outstanding is the work of Wohler, who, between 1850 and 1870, investigated the failure of metals under repeated stress and established the existence of fatigue phenomena.

Of the countries not mentioned, only Sweden was an early contributor of anything of importance to the development of the iron and

* From "Research—A National Resource. II.—Industrial Research." Report of the National Research Council to the National Resources Planning Board. (Washington—1941).

Iron and Steel Research

steel industry. The work of Eggertz on chemical analysis of iron and steel is noteworthy, as is Brinell's development of a simple test for determining hardness.

World Research in the Iron and Steel Industry, 1900 to 1930

A comparison of research in ferrous metallurgy over the first three decades of the twentieth century for the four principal steelmaking countries of the world is given in Table II. The amount of research in any one country naturally varies with the size of the iron and steel industry; thus, more has been done, especially since the first World War, in the United States than in any other country. To consider only the volume of actual research would, therefore, not give a true picture of the research-mindedness of the industry or of the country; hence, recourse was had to calculation of a research factor. This factor was obtained by dividing the number of reports which contributed to the advance of the industry or to fundamental knowledge in ferrous metallurgy, as published in the technical Press, by the total production of steel ingots plus pig-iron, in millions of metric tons.

There are, of course, several objections to a comparison of this sort. In the first place, the results of many research projects, especially those which produce an improvement of processes, are never published. In the second place, it is practically impossible to separate reports of metallurgical research done by the industry itself from reports of research done by the universities and Government laboratories. This is especially true for Germany, where the Kaiser-Wilhelm Institut für Eisenforschung and the Technische Hochschule at Aachen (among others) do a large amount of work, especially of the more fundamental kind, for the steel industry. In the third place—and this is the most important variable—the accuracy of such a comparison as is given in Table II depends to a large degree on the judgment of the individual making the comparison, especially in what constitutes significant research.

Each of the factors in the top half of Table II is the sum of the factors obtained for four main divisions of metallurgical progress, namely:—(1) Important developments in the manufacture of steel and cast iron; (2) important developments in the treatment of steel, including mechanical working, heat-treatment, welding coatings, and other operations connected with these; (3) research in the constitution and structure of carbon and alloy steels and plain and alloy cast irons; and (4) research in the properties of ferrous materials.

Each of the factors in the lower half of Table II was obtained by taking into account only the published Papers dealing with constitution and structure, the physical chemistry of steelmaking, theoretical treatments of mechanical deformation, theory of heat-treatment, and other subjects which were considered to have advanced the science of physical metallurgy.

Comparison of World Research, 1900 to 1930

If it is assumed that the data given in Table II represent with reasonable accuracy the status of world research in the iron and steel industry from 1900 to 1930, several interesting conclusions can be drawn. First and most important: It is clear, considering the size of the industry in the United States, that only about half as much total research was done in that country between 1900 and 1930 as in each of the other three countries. The proportion of fundamental research was even less. Another interesting fact is that the amount of fundamental research (in relation to iron and steel production) in the United States and in Great Britain remained fairly constant for the 30 years under consideration.

In Germany and France the amount in proportion to production varied more erratically. Fundamental research in Germany fell off immediately after the First World War, but bounced up remarkably by 1923, when the inflation was at its height, despite the fact that production did not increase greatly. France contributed a great deal proportionately to metallurgical knowledge in the first decade of the century. In the third decade the research factors are much lower; the amount of research did not increase as production increased. Another interesting point is that, although there is a tendency for the amount of research especially of the fundamental sort to decrease in depression years, the research factor is also lower when there is a sudden boom in the industry. Apparently this is due to lack of time for the work rather than to lack of money. Such a condition is shown for the United States, Germany, and France in 1910 (Table II).

Despite an annual production of steel ingots plus pig-iron of less than 1 million tons, Swedish metallurgists publish between 10 and 20 Papers a year which are without question definite and valuable contributions to the iron and steel industry, especially to fundamental knowledge. No research factors have been calculated for Sweden as the number of Papers and the production of ferrous materials are so small that such a factor would mean very little. Considering the size of the country, however, the research work of its metallurgists is of considerable importance.

The contributions of Italian research workers to the advance of the iron and steel industry have been few, with the exception of the work of Stassano on the electric furnace and of Giolitti on heat-treatment. Reports of importance varied between 5 and 10 annually in 1900 and 1930. Italy's combined production of pig-iron and steel ingots ranged from 500,000 to 2,000,000 tons annually in the same period.

Little work of interest was done by Japanese metallurgists until after the first World War, when the research of Honda, Murakami, Sato and a few others, most of whom were connected with Tohoku Imperial University, attracted attention. Most of the work of the Japanese metallurgists has been on the constitution of carbon and alloy steels and on the development of magnetic materials; nearly all their reports have been printed in English or German.

Russia contributed little to the advance of the iron and steel industry prior to the revolution and practically nothing between 1917 and 1925. Of the relatively large number of reports published in Russian since 1925 fewer than 20 or 30 contain anything of real value.

Outstanding Developments in the World Iron and Steel Industry, 1900 to 1930

It is not within the scope of this Paper to outline all the important developments in the iron and steel industry of the world for the first 30 years of this century. They have been so numerous and so many printed pages would be needed even to catalogue them that it is necessary to limit the discussion in this section to a few outstanding examples.

It is only necessary to note that the output of the blast furnace approximately tripled between 1900 and 1930 to realise that a large amount of important research has been done on this phase of the iron and steel industry. To effect this progress, extensive studies have been made on the beneficiation of ores, the improvement of the quality of coke, on slag reactions and their influence upon the production and quality of the iron and especially on the general design of the furnace itself. Improvements in these directions have been achieved in all principal iron-making countries but have been particularly pronounced in the United States.

The most important research work in steelmaking which has been devoted chiefly to the physical chemistry of slag-metal reactions in the basic open-hearth process was pioneered in the United States by C. H. Herty, Jr., and his associates under the auspices of the Metallurgical Advisory Board of the United States Bureau of Mines and Carnegie Institute of Technology and in Germany by H. Schenck and his associates working at the Krupp laboratories. This work got actively under way about 1925 and is still going on at the Krupp works and at a number of places in the United States. It has had important ramifications in improving the quality of carbon steel and has been accompanied by valuable work on gases and non-metallic inclusions in molten and in solid steel. The most comprehensive and valuable work along this line in England has been that of a committee of the British Iron and Steel Institute which started in 1925 to study the heterogeneity of steel ingots; this work is also still under way.

Alloy steels, the development of which started late in the nineteenth century, were used rarely,

TABLE II.—*Amount of Research by the Principal Iron and Steelmaking Countries, 1900 to 1930.* (*Outputs in million metric tons.*)

Total Research.

Year.	U.S.A.			Germany and Austria.			Great Britain.			France and Belgium.		
	Output.	No. of papers.	Research factor.	Output.	No. of papers.	Research factor.	Output.	No. of papers.	Research factor.	Output.	No. of papers.	Research factor.
1900	24.2	79	3.26	17.7	81	4.57	14.1	69	4.87	6.1	34	5.57
1905	43.7	186	4.25	23.6	184	7.79	15.7	123	7.83	7.6	68	8.90
1910	53.1	121	2.28	32.7	149	4.57	16.9	101	5.94	10.9	44	4.00
1919	66.7	201	3.00	13.9	54	3.86	15.5	86	5.55	5.2	41	7.89
1923	85.3	169	1.98	17.1	97	5.70	15.9	77	4.81	14.8	47	3.18
1928	89.7	291	3.23	39.0	280	7.17	15.1	134	8.93	27.2	41	2.98
Average	—	—	3.00	—	—	5.61	—	—	6.32	—	—	5.42

Fundamental Research.

1900	24.2	16	0.64	17.7	20	1.13	14.1	19	1.32	6.1	14	2.26
1905	43.7	38	0.87	23.6	62	2.64	15.7	28	1.75	7.6	17	2.25
1910	53.1	27	0.51	32.7	47	1.43	16.9	25	1.46	10.9	21	1.94
1919	66.7	44	0.66	13.9	11	0.80	15.5	24	1.53	5.2	11	2.08
1923	85.3	47	0.55	17.1	27	1.50	15.9	16	1.01	14.8	7	0.46
1928	89.7	59	0.66	39.0	56	1.49	15.1	23	1.52	27.2	14	0.51
Average	—	—	0.65	—	—	1.45	—	—	1.43	—	—	1.58

Iron and Steel Research

except for armour and ordnance until after the first World War, when the rapid development of the automobile, aircraft and petroleum-refining industries began to require relatively large tonnages. This is shown clearly by the increase in production from 570,000 tons in 1910 to about 4 million tons in 1930.

Two developments in alloy steels are outstanding—the "stainless" materials and the low-alloy structural grades. There are, as is well known, two classes of stainless steels, the hard cutlery steels, containing 0.30 to 0.40 per cent. of carbon and 11 to 14 per cent. of chromium, and the soft austenitic steels, widely used for structural and ornamental purposes, containing low carbon and about 18 per cent. of chromium and 8 per cent. of nickel. Credit for the discovery of cutlery steel belongs to Brearley, an Englishman, whose research resulted in the patenting of this alloy in 1913. The so-called 18-8 steel is a development by Strauss and Maurer, working at the Krupp laboratories in 1909 to 1912.

The large class of low-alloy steels now being used widely as structural materials, especially for railroad rolling stock, and to a lesser extent for ships, bridges and buildings, is an outgrowth of experience with a few of these materials in the United States, England and Germany, as early as 1910 to 1915, for highly-stressed members of bridges and ships. Some 30 of these steels are known at present, most of which were placed on the market in the last 10 years. The economic significance of these steels is discussed in a later section.

There are two important advances in the steel industry for which American research workers are almost solely responsible. One, controlled grain size, is primarily a metallurgical development. It was first called to the attention of metallurgists by McQuaid and Ehn in 1922, and has received much attention in the past 15 years, with the result that grain size is now a part of some steel specifications. Grain size affects machinability, response to heat-treatment, and the hardness of heat-treated steels. It is controlled by appropriate regulation of the melting process. The continuous-strip mill developed by the American Rolling Mill Company in 1925 and 1926, has reduced the cost and improved the quality of thin flat-rolled steel so much that automobile design has undergone radical changes in the past 10 or 12 years. This, too, is discussed later.

Present Status of Research in the American Iron and Steel Industry

Although metallurgists have been employed by American steel companies, and although sporadic research has been undertaken by a few of the companies for nearly 50 years, metallurgical research as an organised activity of the industry became widespread only about 15 or 20 years ago. Credit for the establishment of the first research laboratory, designated as such, at one of the larger plants is usually given to the American Rolling Mill Company, which began research on ingot iron as early as 1903; six years later twelve research workers were employed there.

Most of the smaller steel mills making a specialty of the manufacture of alloy and tool steels employed one or more research metallurgists between 1900 and 1920. In many cases, however, these metallurgists were engaged in "trouble shooting" rather than in research work. Between 1920 and 1930 the value of research as a separate centralised activity became apparent to some of the larger companies; the Bethlehem Steel Company began research on a large scale in 1926, and Jones and Laughlin followed a year or two later. The central research laboratory of the United States Steel Corporation was established in 1928, although the subsidiary companies, especially the Illinois Steel Company and the Carnegie Steel Company, had employed metallurgists and other technical men for research as early as 1908.[2]

As noted at the outset of this Paper, most research in the iron and steel industry is on processes and products for the purpose of improving methods of manufacture and quality of product, reducing cost, and developing new products and new uses and new markets for old products. Despite frequent statements in the popular press to the contrary, the American iron and steel industry is highly competitive, and each company realises only too well that a competent technical staff is the best insurance for keeping constantly abreast of, and if possible ahead, of technical progress in the industry as a whole. Furthermore, the whole industry realises that, despite the fact that modern civilisation is built upon steel, constant vigilance is necessary to prevent undue inroads by competing materials.

The technical staff of a steel company has another duty, which is frequently overlooked, *viz.*, the job of acting as consultant for the customer. Many small steel consumers and some large ones as well—the railways are an outstanding example of the latter—have for many years expected the steel industry to do practically all of their development work.

For nearly a hundred years steelmaking and the processing of steel into finished and semi-finished products has been an art in which skills of a high order have been developed. Despite the advancement of the art, there are still so many variables in the manufacture of iron and steel that even the most skilled man sometimes has to depend upon "intuition" or a "hunch" to guide him when he encounters conditions which do not fit precisely into his practical experience. The result is a lack of uniformity in quality which costs the steel companies large sums of money because of rejections by the customer. Variable quality in iron and steel has always been a problem in the industry; since about 1920 it has been even more of a problem than before, as customers' requirements have become increasingly rigid year by year.

One of the principal purposes of research by the American steel industry has been to investigate the causes of erratic quality in the finished product and, by increasing technical control of the various operations, to improve the quality of the product and render it more uniform. One-third of the money spent for research has been used for this purpose.[3] One of the most common examples of the effect of research in improving quality is the automobile fender. Had anyone suggested in 1925 making the torpedo-type fender—now used even on the cheapest cars—by deep drawing sheet steel in one operation, both steel makers and automobile engineers would have questioned his sanity.

(To be continued.)

(Continued from next column.)

mould, and it did not differ in behaviour from the bentonite sand. It behaved satisfactorily as far as skin drying was concerned, and chills stayed in position without difficulty. The slightly higher permeability seemed to cause the sand to dry out rather more quickly than bentonite sand, and for this reason it was found that moulds in fullers earth sand should not be left for long periods before use.

Fullers earth behaved similarly to bentonite sand, in that a finished mould or core will not stand misuse, the surface being easily damaged. It was possibly a little worse than bentonite sand in this respect.

During the test period several castings made in this sand included pieces with deep fins.

From the above work it is to be concluded that a synthetic sand containing 4 per cent. of fullers earth as a bond behaves satisfactorily in all respects and can be regarded as an efficient substitute for a similar type of bentonite bonded sand.

Bentonite Substitute in Sands for Mg Castings

By F. A. FOX, M.Sc., Chief Metallurgist, Magnesium Elektron Limited

As is well known, bentonite is, *inter alia*, a sand-bonding material which is imported from the U.S.A., and wartime conditions have restricted supply somewhat. Various materials have been suggested as a substitute for bentonite when used for the casting of magnesium alloys. Chief among these substitutes is a well-known proprietory product based on fullers earth, which is said to be of similar mineralogical constitution to that of bentonite. The note given below indicates the results of tests carried out with this material as a bonding agent and as a substitute for bentonite, a number of more or less complex alloy castings having been made.

For this purpose a mix of "synthetic" silica sand bonded with 4 per cent. of fullers earth was made; 144 lbs. of this mixture was prepared and test figures taken immediately after mixing gave the following results; comparative figures for bentonite bonded sand are also given.

	Fullers earth mixture.	Bentonite sand.
Moisture, per cent.	2.75	3.2
Compression tests, lbs. per sq. in.	6.1	5
Permeability, A.F.A. units ..	125	100

These figures were good, the fullers earth mixture showing a satisfactory combination of strength and permeability.

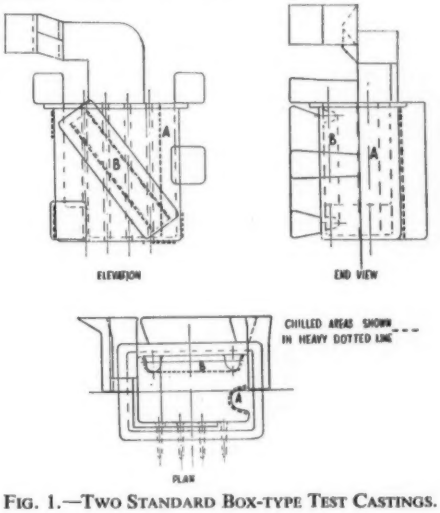


FIG. 1.—TWO STANDARD BOX-TYPE TEST CASTINGS.

Two standard box-type test castings, shown in Fig. 1, were made immediately after the fullers earth mix had been checked. These were most satisfactory and all the fins were perfectly run, and it is interesting to note that this perfect running of the fins is unusual with a bentonite bonding sand. It may have been connected with the higher permeability of the fullers earth sand.

The same sand was used continuously for a period of over two months, during which time it was milled about 40 times; at the end of the period test figures were as follow:—

Moisture	3.3 per cent.
Compression test	8.8 lbs. per sq. in.
Permeability	101 A.F.A. units.

It will be seen that the permeability has gone down slightly, and the compression strength has risen; the sand is, nevertheless, still satisfactory.

In operation on a number of jobs, the fullers earth sand was found to be satisfactory to

(Concluded in previous column.)

D

Institute of British Foundrymen

WEST YORKSHIRE BRANCH ANNUAL DINNER

The West Riding of Yorkshire Branch of the Institute of British Foundrymen, as in each of the previous wartime winters, defied all obtacles and difficulties associated with the organisation of an annual dinner, and held their function for the 1941-42 session on January 10 at the usual venue—the Great Northern Victoria Hotel, Bradford. The number present was less than in peacetime, but well up to the level of the war period. Unfortunately, the President of the Institute (Major Miles), and the General Secretary (Mr. Makemson) were prevented from being present by important duties on matters of national importance, and the Lord Mayor of Bradford (Alderman Louis Smith) was also an absentee in consequence of other civic obligations. The Deputy Lord Mayor (Councillor E. Vincent Heaton) and the Deputy Lady Mayoress were present; and others at the high table were Mr. Joseph Hepworth, M.P., past-President of the Institute, with Mrs. Hepworth; Mr. and Mrs. C. Jessop; Mr. John Bolton, of Manchester, Assistant General Secretary of the Institute, supporting the Chairman and Branch-President (Mr. W. Fearnside, of Keighley) and Mrs. Fearnside. The function, as always, owed its success to the Branch's indefatigable hon. secretary (Mr. S. W. Wise), who was accompanied by Mrs. Wise. Past-Branch-Presidents present with their ladies were Mr. W. G. Thornton, Mr. A. S. Worcester, Mr. S. Carter, and Mr. F. K. Neath, B.Sc. Apologies for absence were received from Mr. MacColl, B.Sc., Mr. F. Oldershaw, and Principal H. Richardson.

After the loyal toast had been honoured, the BRANCH-PRESIDENT (Mr. Fearnside), in proposing "The Visitors," said all present much regretted the absence of Major Miles, the President, and others, but he had no doubts their thoughts were with the gathering at that time. In a reference to Bradford, Mr. Fearnside said the foundry industry, the Institute and the Branch in particular owed the local Education Authority a debt of gratitude for the generous way in which they allowed the use of the Technical College for meetings and lectures of the Branch, and the manner in which they had responded for a good many years to the call for teaching in metallurgy and foundry practice.

The DEPUTY LORD MAYOR, who responded, said the foundry industry was playing a most important part in the country's war effort, and he was sure that it would play an equally important part in the task of post-war reconstruction. He believed in our ultimate victory, but it was well to keep in mind that we shall not be worthy of that victory if we allowed the country to return to the intolerable extent of unemployment which we had before the war. The Institute must take its part in preventing any renewal of that state of affairs. Mass unemployment was a most dangerous thing, and there must be no repetition of 2,000,000 unemployed in this country. There was no doubt at all that it was the 6,000,000 unemployed in Germany—that fact and nothing less—that put Hitler and his Nazis into power. It was felt that it was not impossible that the very magnitude which the world struggle had now reached would encompass its end sooner than might otherwise have been the case, but there existed a responsibility to the time when the war was ended. People must learn not to live unto ourselves but to think of the welfare of others.

MR. JOHN BOLTON, Assistant General Secretary of the Institute, proposing the toast to the West Riding Branch, said it was a great pleasure to him to renew an acquaintance with the members of the West Yorkshire Branch, which he first made at the Bradford conference in 1938. Mr. Makemson asked that his good wishes be conveyed to the gathering and his deep regret that he was not able to be present. The Branch was to be congratulated on the excellent work it is maintaining, in spite of the many difficulties inevitable in such a time. He was particularly interested in the novel form of the series of Papers and discussions this session, dealing in the progressive stages of a single product, and he was glad to learn how well it was going. Technical education in the foundry industry had always been important, and never more so than now, when members must prepare themselves for an after-war period of great competition and must have an adequate number of skilled and trained foundrymen to ensure proper progress. The Branch had always shown an admirable interest in technical education, and it was greatly to the credit of the Council and the members—and also the hon. secretary (Mr. Wise), who had done so much for the Institute—that the Branch had been able to prepare this basically educational programme. The Branch has now been in existence 20 years, and for 18 of those years Mr. Wise has done outstandingly good work as Branch-Hon. Secretary and on the Council of the Institute. After the war much would depend on collective action in industry, and this Institute was in being for the use and good of all those engaged in foundry work who cared to take advantage of its help, and there was a welcome for all who would associate themselves with the Institute to ensure that the industry was well and properly regulated. The Institute could be all the more use in this direction if its Branches and its functions were kept successfully active through the war period, and the West Riding of Yorkshire Branch was certainly to be complimented on doing that.

The Post-War Programme

MR. JOSEPH HEPWORTH, M.P., responding, said, on behalf of the Branch, he welcomed the Deputy Lord Mayor as a business man whose slogan was "Britain can and will deliver the goods." That was a slogan they must all live up to in these times. It was true to say that this Branch could do very much towards preparing to deal with the problems Britain will have to face when the war was over. The foundry industry was the key to the success of every other industry dependent on war material. If Britain faced its future problems with the same courage and in the same spirit as it had done those of the past, he was certain that it would win through successfully. The nation, the youth of which was trained scientifically, combined with a high standard on the practical side, was bound to go forward, and it was the Institute's job to see to it that it developed the industry to the highest possible standard of efficiency.

Many people to-day were worrying and asking themselves what was going to happen to industry after the war was over. Worrying was useless. A solution could only be reached by organised planning by practical business men who had something in their heads beside their tongues. There must be no repetition of what happened after the last great war—abnormal unemployment, people existing in slums, falling markets, and chaos in industry. If practical men co-operated, the world would find a solution to whatever was coming in the way of after-war problems. They needed only to look around the present sadly disturbed world to see great spaces which were undeveloped and would be crying out for goods. China, Russia and South America would all be waiting after the war for the young salesmen—that was not catalogue men, but men scientifically trained who understood the practical part of their job and their industry; men who would go out and meet all requirements and settle their needs and problems on the spot. If Britain wanted trade, it would have to go out and look for and find it, and not sit at home expecting it to come seeking us.

In conclusion, MR. HEPWORTH hoped that when the West Riding Branch of the Institute met next year for their next annual dinner, they would meet under happier circumstances. He was not pessimistic concerning the ultimate result of the war. Now that America and Japan had entered the war, he felt—though he had no official grounds for saying this—that there would quite possibly be a sudden collapse of the Axis Powers at no distant date.

The speeches during the evening were interspersed with items of music and entertainment by an excellent concert party, and a happy function was brought to a close about 10.15 p.m.

Dehydration of Blast-Furnace Air

A dehydration plant of the absorption type developed by the Blaw Knox Company, Pittsburgh, for the conditioning of blast-furnace air, is fully automatic and requires only the normal supervision of motors and control equipment. Under the usual conditions found at most plants blast air can be supplied to the stack at any moisture content down to 1½ grs. per cub. ft.

Experience with the first installation, which has been operating for a year at a steelworks, demonstrates that the equipment has great flexibility and that the method employed for dehydration lends itself to low operating costs. There is evidence that the theoretically figured benefits in increased tonnage, reduced coke consumption and improved quality in the iron as a result of using dry blast will be realised to an appreciable degree.

The plant is designed to remove both water vapour and dirt from the blast air, controlling the air going to the blowing engines at a predetermined vapour content and temperature. The vapour is removed by absorption through contact with a hygroscopic salt solution. Heating and cooling coils ahead of the dehumidifier maintain the outlet air at the predetermined temperature, depending on the solution concentration and the cooling water available. The water vapour picked up by the solution is then, in a constantly operating closed cycle, driven off by heat supplied in steam coils, so that the solution is maintained at the desired specific gravity corresponding to the set constant grain loading desired. The dirt is removed from the air by means of a continuous oil bath filter.

Industrial Developments in India

One of the most important factory expansion projects in India recommended by the Chatfield Committee has now been practically completed with the installation and putting into use of an open-hearth furnace at a new works. The new works actually replaces an old steelworks, which, in its turn, is being dismantled for the re-equipment of the buildings as a heavy bomb factory. A 2,000-ton gun-forging press has been installed in another factory and has successfully undergone trials. Several shell-forging presses have also been installed. The first of them has already passed its trials satisfactorily and is now being taken into commission for the forging of shells. In civil armaments production, progress continues to be made in the manufacture of shells, fuses, mortar bombs, anti-tank mines, and various components. The first roller bearing produced in India outside of ordnance factories has recently been manufactured by a railway workshop. In the engineering sections, work is proceeding on many products, including cast-iron pipes and railway material.

Patternmaking and Pattern Design*

A PLEA FOR THE STANDARDISATION OF RAIN-WATER GOODS

By R. R. SHAW

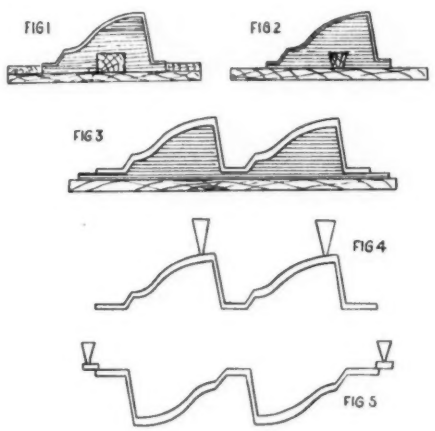
Falkirk has for a very long time been the centre for the manufacture of rain-water goods. The moulders who make these goods have reduced production to a fine art, so that experienced men who have spent the whole of their lives in an engineering foundry, or a jobbing foundry, would hardly credit what a day's work from a gutter moulder amounts to. While these moulders are not as a general rule versatile men as far as general knowledge is concerned, they are often experts at their own trade. One can often glean some very valuable information by having a talk with men such as these, as much of their knowledge has been gained through long arduous years spent in making the same type of goods. Ask them, however, if they have any suggestions for improvement in manufacturing methods, and the answer will in all probability be "No." The information will be volunteered that in a particular foundry the patterns are quite good, the moulding boxes passable, the sand and iron satisfactory, and any difficulties experienced are incidental to the running of the foundry. Therefore, any change that one might suggest would probably not have their approval. Discuss the same affair with the foundry manager, or a foundry foreman (a good practical man), and he will sing the same tune of "Let the established practice of generations be unaltered." To be sure, the moulders know the work, and the firm is satisfied, therefore there seems to be no use making a change merely for the sake of a change. Discuss the subject with the patternmakers, and ask them how they make the pattern for a gutter plate. They will probably give a variety of answers of different methods, but in every case there will be a final statement, that there is never any difficulty in giving the moulder a very satisfactory gutter plate pattern. In this connection it is felt that it is a very good maxim for every industrialist to consider that there is nothing manufactured that cannot be improved. If this principle be held rigidly to, progress must be made, although every experiment is not necessarily successful.

There may be several methods for making a gutter plate, but only one can be the best, so that there is reason for discarding the remainder. Let the members of the Institute see if they can find a satisfactory set of answers to the question. Quite revolutionary ideas will be postulated, and the author asks his readers to have no preconceived notions as to the method, so that he may argue logically from the known facts. First of all, considering the commonest methods of current practice, their development may be traced up to the stage of the plate pattern, and points may be shown where they are unsatisfactory. Then from the available data he will endeavour to explain a new technique, which eliminates these unsatisfactory features.

First Method

The first method is shown in Fig. 1; in this method two templates are cut in sheet zinc, one representing the inside size of the gutter, and the second its outside size. These two templates are soldered together, so that the difference between the one and the other is the section of the gutter. These templates are then mounted on a strickle. Next, a yellow pine board 8 ft. by 10 in. by 1½ in. is surfaced, and two wood strips 2½ in. broad, the full length of the board are fixed on either side. These two strips are shaped to the convex the gutter requires. The amount of convex is determined from previous experience, and represents the camber of the cast-iron patterns, plus the camber of the plate, plus the camber of the casting. Some rough timber is now fixed down the centre of the board in order to give the stucco a grip on the block. Thick stucco is placed on the centre of the board, and there is continual application while the template is passed over the board, resulting in a stucco block shaped as the inside of the required gutter.

At this point the block will be warm, due to the evolution of heat (with steam formation) caused by the exothermic reaction between the stucco and water. As the block becomes hot, an expansion takes place, necessitating the testing of the convex at this stage in order to make sure that the heat has not altered it. When the block has cooled it is varnished with



shellac and coated with grease. The block template is removed from the strickle leaving the thickness template only. Before sweeping up the thickness, it is advisable to solder an ordinary moulder's sprig to the thickness template, at about the highest point of the gutter, and allow this to protrude almost to the block, so that the thickness will be split in two in the process of sweeping. Stucco is next applied to the block, and the template passed over a few times until the result is a stucco gutter. This gutter is cut across, in six lengths of 12 in. each. The pieces are numbered, so that they may be replaced in the same positions as they came off. The sectional stucco gutter, mounted on the block, is taken to the pattern moulder, who makes two cast-iron original patterns, casting them with four gates on the top side.

Second Method

The second method is a slight modification of Method 1, in so far that the whole board is shaped to the required convex, thus eliminating the two strips down either side. The idea behind this is that the side expansion of the stucco block is apt to push the strip out from the board, and since the strickle works on one side of the board only, there is no possibility of having a thick side and a thin side to the gutter due to expansion of the strips. The other stages are identical to those of the first method.

Third Method

This method, shown in Fig. 2, is a modification of Method 2, with the exception of the rough timber down the centre. This is replaced by a perfectly parallel rail of timber, tapered on its breadth from 2 in. to 1½ in., and screwed to the centre of the board. This allows the stucco to expand longitudinally, thereby eliminating tendency to warp. Care must be taken to fill all screw holes with grease, and also to coat the whole board with grease, so that the block can slide on its own length. Otherwise the method agrees with 1 and 2, the pattern moulder making two cast-iron originals, casting them with four top gates.

Fourth Method

This method, shown in Fig. 3, is radically different from the others, being as follows:—The block and thickness templates are cut from sheet zinc as before, only in this case *two* gutters are cut out, ¼ in. apart. Before soldering together, the thickness template is lifted vertically, ⅛ in. *above the block* template. This allowance represents the thickness of the plate. The convex of the board on this occasion is only the camber of the casting, plus the camber of the plate. The sweeping of the stucco block and thickness are accomplished as before, excepting that the partings at the spigot and faucet ends are made in stucco by the patternmaker, great care being observed at this stage, in order to avoid crush or fin on the resultant castings. This difficulty can be eliminated by moulding the plate in a box having ends shaped to the contour of the pattern. The pattern moulder now makes the plate direct from the stucco pattern, without the necessity of making two cast-iron patterns, as in the other methods.

The moulding of the plate in Methods 1, 2 and 3 is as follows:—Two cast-iron patterns are mounted on a board, and moulded in a perfectly straightforward manner. Moulding being complete, a plate frame, shaped to the outer contour of the plate, is placed at the parting, on the drag side. All the sand from the plate frame to the outside of the drag is made up by ⅛ in., *i.e.*, the thickness of the plate, and the box is closed on risers of that thickness, placed on the fitting strips of the box. The plate is now cast with six gates, three at the top of each gutter.

Weaknesses and Disadvantages

Method 1.—(*a*) The board is liable to warp through expansion of stucco block. (*b*) Three cambers are encountered, each of which is difficult to control, every pattern having a camber peculiar to itself. (*c*) There is no previous indication of position of gates, should the gutter be liable to side warping. (*d*) There cannot be an indefinite number made from the stucco, since it is very fragile and liable to break at any time. (*e*) No adjustment can be made for a major fault. (*f*) Expansion of the stucco block may cause a heavy side near the strickle, and a light side remote from same.

Method 2.—Fault (*f*) only is eliminated.

Method 3.—Faults (*a*) and (*f*) are eliminated.

Method 4.—This method has much to recommend it, although great skill on the part of the patternmaker is called for. Provided that the contour of the gutter is carried through the ends of the moulding box, the possibility of a fin or crush is eliminated, both at spigot and faucet ends. Faults (*c*), (*d*) and (*e*) are still present, and fault (*b*) is only eliminated to the extent of one-third.

The Cast-Iron Plate Pattern

Consider the making of the plate by any of the above four methods. In the section, one will observe that the heaviest part of the casting is concentrated at the tip, where there is the thickness of the gutter, plus the thickness of the plate. This will be due to the fact that it is gated at this point. The heat is retained at the point, which gets the last of the metal, and this

* Extracted from a Paper read before the Falkirk Section of the Institute of British Foundrymen, Mr. T. Tyrie presiding.

Pattern Making and Design

is coupled with the fact that this is also the heaviest section. This means that the tip contracts last, a point which is often manifest by the appearance of a hot tear running diagonally from the spigot and faucet ends to the corner of the plate (Fig. 4). Any person having a knowledge of metallurgy can readily see why this casting requires camber, and is always in a strained condition.

An attempt will now be made to describe a new technique, which can be claimed to eliminate all these faults, both in pattern and plate.

A New Technique

A section of gutter, 12 in. long, is swept up in stucco on a perfectly straight board. Six castings are made from this, in tin-lead alloy, using a very high alumina sand. These castings are required to be so carefully made that they only require a little cleaning with a small file. A board is next surfaced perfectly flat, and mounted on this board is a wood block made to the section of the inside of the gutter. The six pieces of tin-lead alloy are placed on this block and soldered together. This gives a perfectly straight gutter in tin-lead alloy. This pattern is next passed to the moulding shop, where a trial casting is made in the gutter moulder's sand heap. This is made and cast in exactly the way of an ordinary gutter, three top gates being again used. This trial can now furnish the following useful data:—(1) Whether the casting is the correct weight. If not, adjustment can be made on the pattern; (2) the amount of camber which the casting has taken; and (3) that the three gates are in the correct position, in which case there will be no side warping. If the position is correct, a heavy cut should be made in the pattern to mark the spot.

The pattern is next passed to the pattern moulder, who makes a casting by parting out the inside of the gutter in the cope of his mould, casting with three small yankee runners down each side. A special moulding box, with the cope bars projecting down to within ¼ in. from the pattern, should be used. The cope should also be as shallow as possible, otherwise the pressure of the metal will be excessive, causing an increase in the weight of the casting. This would prove fatal to the experiment, as the results would mislead the patternmaker. From this trial, the camber is noted, the weight compared with the casting from trial No. 1. The wood block is next unscrewed from the board, which is cambered to the convex, to the same extent as trial No. 1 was concave, plus or minus the camber on trial No. 2, the latter value being very small. The convex on the board being complete, the wood block is replaced, and the tin-lead pattern placed on the block, and weighted down until the alloy has taken the set of the block.

The pattern is returned to the patternmoulder, who makes two cast-iron patterns in the same manner as trial No. 2, so that the cast-iron pattern produced will have the camber of trial No. 1 only. A probable question at this juncture is, "What about the camber for the plate?" An attempt will now be made to explain a method of making a plate, which (depending on the gutter) may take no camber whatsoever, and which completely eliminates the highly objectionable feature of the hot tear at the spigot and faucet corners. When the two cast-iron patterns are filed they are mounted on a board and moulded so that the inside of the gutter is parted out in this cope. The plate frame is placed on the drag half of the parting, and the plate is made up by five-sixteenths of an inch, and cast with three yankee runners on each side. These runners are broken off immediately the metal has set. A glance at the section of this plate (Fig. 5) will be sufficient to show why it is not susceptible to camber, because the heavy section gets the first of the metal, which incidentally is cooler, due to its passage over a considerable sand surface. The cooling will therefore be much more uniform, thus minimising stress through contraction. It will also be noted that on this plate there are three marks on each gutter to show where the moulder must place his gates. Reasonable assurance may now be felt that the moulder has a plate pattern from which he can make straight castings of the correct weight, also that there will be little possibility of the plate cracking at the ends through normal usage.

Returning to the original remarks about the moulder never considering improvement in production methods, and the management never caring to interfere with older methods, it is shown how the moulder is saved the necessity of taking perhaps 10 per cent. of his day's work to the straightening fire before being paid for it, while the management is saved the expense of giving away pounds of redundant metal without charge. The article itself is superior in quality.

Standardisation

There can be no logical reason whatever why rain-water goods should not be interchangeable, regardless of place of manufacture. The author feels that a committee should be appointed by the trade to draft a British Standard Specification for rain-water goods on a parallel with that existing for soil pipes, and it is certain that the Falkirk Section of the Institute would co-operate to the utmost. At present, most manufacturers measure, say, the common half round gutter from centre to centre of the metal, while others use the overall outside dimension. Other methods are inside dimensions, making a complete semi-circle, etc. The case of the O.G. gutter is particularly chaotic, and an architect or builders' merchant has no guarantee that he will be able to replace a piece of gutter at any time similar to that placed on the building. Complete standardisation would eliminate nine-tenths of the present designs; indeed, all patterns should be made from the same master, resulting in uniformity of design, weight, etc. Such a system, once in operation, would allow ironfounders to settle down to proper mass production methods for rain-water goods.

Finally, since this is the first occasion on which a Paper or talk on this subject has been given to the Falkirk Section, the author hopes that it has been of interest, and perhaps a little instructive to men to whom rain-water goods are most familiar commodities. An attempt has been made to reason out the subject in both a practical and a technical manner, and the author hopes that his method will arouse keen discussion among the members.

DISCUSSION

After the delivery of the Paper, MR. TYRIE (the chairman) said that he considered that Mr. Shaw had given a very interesting lecture, and he believed the speaker to be very wise in choosing one subject bearing on his title, and elaborating on this, in place of trying to cram a miscellany of objects into his Paper. Gutters were very common to the Falkirk district, and he (Mr. Tyrie) felt sure that Mr. Shaw would receive many queries on his subject, more especially on his method of producing a perfect pattern plate for this type of casting. He also expressed the belief that definite action was necessary as regards standardisation of design, weight, etc., of rain-water goods.

In thanking Mr. Tyrie for his remarks, MR. SHAW said that he considered that some little co-operation was necessary between manufacturers, so that by making patterns from one master pattern, all the varying factors in rain-water work could be made to agree.

MR. GEO. C. WILSON (Camelon) said that there had been a suggested standardisation for common, half-round, and O.G. gutters, but this seemed to have fallen through. With regard to Mr. Shaw's method of producing a straight pattern plate for gutters, he considered that this was not entirely possible, due to the variation in camber between the two sides.

In reply, MR. SHAW said that he believed that the difference in bend was due to the normal method of running by top gates, which meant that the thickest part of the casting, the last of the metal, and any slag, etc., would all be uppermost. In his method, gating was different, and definite positions for the gates would be marked on the pattern, thus eliminating many of the causes for faults being developed. At the present time, although practical gutter moulders had amassed many "tips" for their trade, there were still many gutters which had to go to the straightening fire, and he maintained that this was purely due to lack of sufficient intelligence being used in the making of the pattern, and the setting of the gates. It was a long-established fact that many foundries made patterns having little discrepancies, but these patterns were put into service in order to save the expense of a re-make. He stated likewise that the making of gutter patterns in tin-lead alloy was, of course, old practice, but he believed that his complete method was new.

MR. WILSON further mentioned that, in his experience, the pattern moulder allowed less for bend than did the gutter moulder, and he seldom found any plate capable of having good castings made from it right from its coming into service. After several months, however, it would become very satisfactory.

In a further statement, MR. SHAW said that he believed that quality of iron was very important in the manufacture of rain-water goods, and his experience indicated a fluid iron of about 1.5 per cent. phosphorus, coupled with a silicon content of 2.8 to 3.0 per cent. As regards the difference in bend allowance between patternmoulder and guttermoulder, he would explain this by referring to the difference in quality of the sands used, those of patternmoulders being much finer than those favoured by guttermoulders.

MR. TYRIE said that he favoured Mr. Shaw's method, because the method of the running would cause even more distribution of heat. In answer to a possible question that mould ramming would be an important variable in making pattern plates, he mentioned a case where he had found but three points difference in mould hardness, over a foundry with about 250 moulders.

MR. JOHN D. SMITH (Falkirk) verified that no two men produced similar gutters from the same pattern, but maintained that some men would produce very good castings from the worst of pattern plates.

MR. SHAW agreed, because of the number of variables entering into the question, such as analysis of iron, sand condition, etc.

MR. EDWARD CUNNINGHAM (Stenhousemuir) thought that the most successful gutter plates were produced where there were the minimum of operations between the making of the stucco pattern and the actual plate. He had tried the parting-out method, but was doubtful of its value, as a special box was necessary for each pattern plate.

MR. SHAW emphasised that the intermediate tin pattern had to be perfect in his method.

MR. WILSON thought that designers were to blame for the chaotic state of the rain-water goods industry, and the meeting agreed that standardisation was very necessary, with which remarks Mr. Shaw was completely agreeable, adding that he thought the ironfounders could learn a great deal from the makers of moulded asbestos composition goods.

After several members had voiced their appreciation of Mr. Shaw's remarks, Mr. Thos. Tyrie, the President, called for a vote of thanks to Mr. Shaw. This was accorded, and the meeting duly closed.

The Economical Use of Moulding Machines for Semi-Mass Production*

AN ANALYSIS OF PRACTICAL POSSIBILITIES

By H. H. JONES†

The moulding time on any given job may vary quite considerably, according to the moulding method adopted and the organisation of the foundry, and it is the object of this Paper to present very briefly a few hints on the application of moulding machines to the everyday problems of the average South African foundry.

It is an impressive sight to see a modern mass-production continuous-casting foundry in full swing, every movement timed and controlled to fit in with the whole. Most foundrymen, however, will agree that efficiency is far more readily attained in a mass-production foundry than in a jobbing shop. This is because the mass-production foundry, with its uniform output, presents just one set of problems. These can be tackled and overcome, one by one, until the plant functions harmoniously. The huge output amply justifies the expenditure of time and money on development work.

In a jobbing foundry, on the other hand, almost every job is a compromise. The method chosen depends on the quantity of castings required, and the equipment that happens to be available at the time. To what degree can a jobbing or small quantity production foundry be improved by adding moulding machines to the equipment available? In view of the advance of mechanisation in almost every department of everyday life, this question merits consideration.

All-round Expansion

The answer to the question can only be determined by a study of all the facts. If a machine is going to be a success, it is going to turn out more moulds. That means more boxes, more sand, more cores, more metal, more patterns, more space, more handling facilities, and more work in the fettling shop. In other words, it is going to mean all-round progress and expansion, for, as a moulder said the other day: "A foundry with machines always has a floor full of moulds."

In a mass-production foundry, any "bottlenecks" become apparent immediately. In a jobbing shop they are less obvious, but almost equally detrimental to the output. If a machine is to be given a fair chance it must not be seriously hampered by "bottlenecks," causing congestion, or starvation, anywhere in the plant. However, the object of this Paper is to show how moulding machines can be made to produce good results under average South African semi-mass-production conditions.

Division of Moulds into Groups

The first consideration is the type of work generally undertaken. This can probably be divided for convenience into four general groups, as follows:—

(1) Moulds for small iron or non-ferrous castings which can be made from match-plate patterns.

(2) Moulds for fairly small castings from half patterns, or with flat tops and of a shape which permits drawing by the stripping method.

(3) Moulds for fairly small or medium castings where the mould must be turned over before drawing.

(4) Moulds for fairly heavy castings in boxes up to a specified overall size and weight.

Having determined which of these groups of castings it is desired to put on the machine. the next question is the type of machine to employ. Moulding machines are made in scores of different designs. Some models are suitable only for high-speed mass production; others are versatile machines of designs which facilitate the rapid changing of patterns, box sizes, hardness of jolt blow or degree of squeeze pressure; these features are vital in machines for short-run work. The best known designs may be divided into the following categories: plain jolts, plain squeezers, jolt squeezers, jolt strippers, jolt squeeze strippers, jolt rollover pattern draws and jolt rollover squeeze pattern draws.

Choice of Machine

Taking the first group, *i.e.*, moulds for small iron or brass castings, most of this work can be put into snap flasks (slip boxes) and made from match-plate patterns. Usually the appropriate type of machine is the jolt squeezer. For instance, a pattern board for a 9-in. pulley is easily put on the jolt-squeezer machine. The pattern itself is perfectly normal, and in this case is sunk in the board for convenience and to reduce the thickness of the board required. To do this takes only a few minutes in the pattern shop, and the moulds can then be turned out rapidly in the snap flask. The assembled flask and pattern board are put on the machine, drag half uppermost. The drag is filled with sand and a bottom board jolted down into it. The flask is then turned over by hand, this operation calling for knack rather than strength. The cope is now filled and squeezed to a predetermined pressure, according to the setting on the release valve of the machine. (The squeeze board should have bevelled edges to trim off the top edges of the cope and ram them extra hard.) The cope is now drawn with the aid of the accurate guides on the flask, and with the help of the knee-operated vibrator; then the pattern plate is drawn by the same means, and the mould blown clean, cored if necessary, and closed, after which the flask is removed, and the mould placed on the floor. The moulds may be jacketed before pouring, or metal bands may be set in one or both halves to withstand the pressure of the metal. A rubber cone may be used to make the downgate in the cope; the cone is set in the sand when the box is filled, and compresses readily under the squeeze pressure. As soon as the squeeze pressure is released, the rubber cone pops up conveniently, leaving a smooth, clean and firm down-gate.

A great deal of jobbing work with flat tops can be put on the jolt squeezer machine in the same manner. The normal patterns are screwed on to the board, with runners added—perhaps ten or fifteen minutes' work in the patternshop. Then the moulds are made in a few minutes. In practice it pays to put even jobs of one or two off on the machine; apart from any saving of time, there is the much greater assurance of getting sound castings, due to the uniformly rammed mould. Working by hand, it is not at all unusual to strike the pattern when ramming (especially with the pegging rammer) and produce hard spots, which mean wasters and damaged patterns and the job to do all over again.

An example of the adaptability of the jolt squeezer machine is provided by an order for 500 bulky cores for plough shares. By hand a good moulder, working hard, made 36 cores a day, with the aid of a special wooden guide, which was made up to assist in drawing the corebox. The small jolt squeezer machine was then tried. Jolting only, and using the vibrator for drawing the corebox, with the help of the same wooden guide, an apprentice easily made 100 a day.

Handling and Storage of Patterns

The match-plate machine should not be stored on shelves, but hung up on hooks in the pattern store, or, if used frequently, near the jolt squeezer machine. The foreman can then set out the day's work for the moulder by hanging up various pattern plates in the order in which they are to be used. The plates should be grouped, so that any adjustments to the machine set-up, such as altering the height of the squeeze head, or varying the setting of the squeeze pressure release valve, need be made only when changing from one group to another. Every pattern plate should be fitted permanently with its own set of guides or bushes correctly adjusted, so that it may be put into commission at a moment's notice. In this way a good output can be achieved, although the patterns may be changed many times in the day.

For the second group, involving half-patterns, there is a wider choice of machines. A plain jolt table could be used, and will almost certainly be a help for average jobbing work; the simplest pattern mountings can be employed. For flat tops and other cope moulds not requiring accurate pattern draw, plain jolters are ideal. The machine will save time on the ramming and do a better job—and, after all, ramming is the most important part of moulding. The usual procedure is to jolt the mould, flat ram the top surface by hand, if necessary, then turn the box over by hand or crane, and draw the pattern by hand, possibly with the aid of a vibrator.

Use of Jolt Squeezer Stripper

The next development is the jolt stripper, which is a plain jolt with the addition of a stripping device, consisting usually of four pins which rise evenly and push the box up off the pattern, while a vibrator operates to assist the draw. A stripping plate may be used, if necessary, to support the mould so as to avoid collapse during the draw. Jolt strippers are extremely useful, adaptable machines for either long or short-run work, but they have the limitation that moulds with deep pockets cannot be drawn by the stripping method, since they must be turned over before the pattern can safely be withdrawn.

Adding the squeeze feature to this type of machine produces the jolt squeezer stripper, which should receive careful consideration for the work in Group 2. These machines are extremely fast. High-speed mass-production of cope moulds is their strong point, but they can be adapted to the semi-mass production of both copes and drags very successfully. The type of machine having adjustable lifting pins is far more suitable for jobbing than the lifting frame design.

The method of using a jolt squeezer stripper machine for semi-mass production is to put down a number of drag moulds (which are turned over by hand), then change patterns and make the copes, which are completed in the correct position for closing.

For the third group, involving the turning over of the pattern, the jolt rollover (or rockover) pattern-draw type of machine, which is made in many different designs, is worthy of consideration. For jobbing or fairly small quantity production, the machine should be as versatile as possible. The rockover design, of the Osborne type, possesses many desirable characteristics, such as the ability to accommodate a wide range of flask lengths, widths and

* Paper read before the South African Branch of the Institute of British Foundrymen.

† Of G. H. Langler and Company, Limited.

Use of Moulding Machines

depths; a fully adjustable jolt; a highly adaptable clamping system; an automatic air-operated levelling device for the draw; oil-controlled pattern draw; and roller device to remove the completed half-mould.

As an example of the use of this type of machine for jobbing, a foundry received an order for 20 cast-iron electric junction boxes, of dimensions about 15 in. by 15 in. In this case the actual sample could be used as a loose pattern, and all that had to be done was to make a couple of joint blocks which were screwed to the standard board equipped with pins to fit the standard boxes. The box was filled, jolted, struck off, clamped and rolled over under power. The cast-iron pattern remained in the mould by virtue of its own weight while the draw table descended. The jolt table was rolled back and the box, still containing the pattern, was taken off by means of a small crane serving the moulding machine only. The top box was then rammed by hand by another moulder, drawn, the pattern removed, and the box closed. If a second sample had been available, the machine could meanwhile have made a second drag, but even with only one pattern the time was cut practically by half as compared with hand work, and, while the machine was waiting, it was used by other moulders for jolting flat tops.

Another example was an order for gearbox castings. By hand, an apprentice made three in a day, but when the pattern was put on the rollover machine, he easily made twelve in a morning.

High-Grade Patterns

Orders for fairly small quantities of castings, which are likely to be repeated, will usually justify making a first-class set of metal patterns on a board. A loss may be shown on the first batch of castings, but this will soon be more than made up on future orders. Patterns mounted permanently on plates or boards also show a very considerable saving in wear and tear over a period, due to the ease with which the plates are stored in racks in the pattern store. Indeed, it is most impressive to see the difference between the orderly racks holding the machine pattern plates, and the usual jumble of loose patterns lying about on the shelves of a pattern store, occupying many times as much space, and much more prone to damage and loss.

Increased Scope

The question may be asked why such an elaborate machine as the jolt rollover pattern draw is recommended for a general jobbing shop. One reason is that the machine increases the shop's capacity to quote competitive prices and quicker deliveries if inquiries for quantities come along.

In the machine shop, many firms are quite prepared to instal elaborate machines such as boring mills, with all sorts of expensive features which are comparatively seldom made use of. These features are valuable, because they enable the shop to perform a greater variety of work. That this point applies with equal force to the foundry, is becoming recognised more and more to-day; indeed, the foundry machine is likely to bring a greater return for the money invested.

Another reason is that the completely machine-made moulds are more dependable, and even if it took longer to make them on the machine, it would be worth while, because of the saving on wasters, which may only be discovered after they have been fettled and partly machined. It sometimes occurs that a moulder, working by hand on one job, constantly becomes very proficient at it; but if he goes away on leave, there is trouble. If the job is being made on the machine, the change of moulder will scarcely affect the output.

The jolt rollover pattern draw machine may be regarded, for jobbing purposes, as being made up of a plain jolt machine, a rollover device, and a pattern-drawing machine, and these features may be used independently. For instance, flat tops will merely be jolted, not rolled over or drawn.

With certain shapes of pattern having deep vertical walls, a moulding machine may sometimes manifest a tendency to produce ram-offs. In almost every case this may be overcome by adjustment of the length of the jolt stroke or the hardness of the jolt blow. It is essential that the machine be level, otherwise ramming-off is bound to take place.

Jolt Rollover Squeeze Pattern Draw

Another type of machine to consider is the jolt rollover squeeze pattern draw. This is the rollover type with the addition of the squeeze feature. This type is extremely fast and is somewhat better suited to mass production than jobbing, since rather more adjustments must be carried out to suit the box in use, and the gating has to be carefully considered. The type becomes expensive in the larger sizes, due to the heavy squeeze pressure required to be effective for large boxes. Generally speaking, the rollover machine without the squeeze is preferable for short-run work.

In considering the large moulds in the fourth group, it is wise to select a big machine that will embrace a range of jobbing work sufficiently wide to keep the machine reasonably busy. Except that squeeze machines are practically ruled out owing to the large sizes of the boxes, the remarks concerning Group 3 apply in the main to Group 4 also. Plain jolt tables or large jolt rollover pattern draw machines of adaptable design will probably prove most suitable for average heavy jobbing work.

In every case it is necessary to take advantage of the productive capacity of the machine by keeping it fed with sand and boxes, and removing the finished moulds without delay. A short length of roller conveyor, or a small pneumatic or electric hoist on an overhead runway, will add but little to the cost of the moulding machine, and will enable the output to be multiplied several times. An efficient overhead hopper supplying sand to the machine will also help greatly, but at any rate a supply of conditioned sand should always be immediately available.

DISCUSSION

The PRESIDENT (Mr. J. Tonge) thanked Mr. Jones for the trouble he had gone to in preparing the Paper at short notice. Some months ago there had been a very interesting discussion and Paper on foundry mechanisation, and the general opinion of the meeting was that mechanisation was quite all right when everything went all right, which was not always the case.

MR. LION-CACHET said that he had been pleasantly surprised to find that Mr. Jones had tackled one of the most difficult problems of the foundry industry. Mr. Jones had tackled it very well, and had avoided a number of pitfalls very successfully. He himself had always been in favour of mechanisation, but not of over-mechanisation—there was a big difference between the two. Though South Africa did lend itself to mass production in some respects, the industry was engaged mainly on jobbing work. Jobbing work not only involved different sizes and types of castings, but also the use of different sands. In addition there were castings in which the mould had to be dried, and others in which, for economical reasons, only the top was dried. He had discovered that if he wished to employ a moulding machine economically, and obtain anything approaching the capacity of the machine, the floor space required for putting down the moulds was so great that most South African foundries were not adapted for the purpose.

If the moulds had to be dried it was necessary to have a drying footage, which one day would be enormous and the next day very small. If several machines were employed in the foundry, it was very difficult to co-ordinate them so as to have only one machine making mouldings which had to be dried. It was impossible to get away from conditions where all three machines were working on moulds which had to be dried. Since there was not sufficient floor space for the purpose, the consequence was that either some moulds would have to be left over at night or the whole capacity of the factory had to be reorganised. The speaker made it clear that he was referring only to grey iron foundries. In conclusion, he stated that in his opinion the moulding machine had come to stay. It had not only helped the industry, but had also had beneficial effects on the moulders themselves by taking out of their trade that portion of the work which was least skilled. Large castings in which real skill would be required would have to be made on the ground for many years to come. On the other hand, the use of moulding machines for small castings allowed moulders to devote more attention to the metallurgical side of the work. He felt that it was desirable for moulders to have a thorough knowledge of the materials with which they worked and their behaviour, and thought that this was one of the benefits which moulding machines had brought.

MR. STONES wondered if foundrymen had really got down to the fundamental principles of production, and recalled the results which used to be achieved in Britain by the use of plate-pattern moulding. In South Africa they did not have repetition orders on a scale sufficient to warrant the use of elevators, and he suggested that in some respects machine moulding had been overdone at the expense of plate-pattern moulding.

MR. LION-CACHET stressed the physical hardships involved in plate-pattern moulding, and welcomed moulding machines because they enabled a far greater output to be obtained with far less physical effort. In this connection he recalled the definition that anybody could shovel sand, but an engineer was a man who could shovel twice the quantity in half the time and without the sweat.

MR. STONES pointed out that he was not speaking in terms of thousands, and maintained that in some cases small jobs could be done with much less labour by plate-pattern moulding than by using machines.

MR. BRAGG and MR. TONGE were both in agreement with Mr. Lion-Cachet that the days of the plate-pattern moulder were over.

Newfoundland Ore

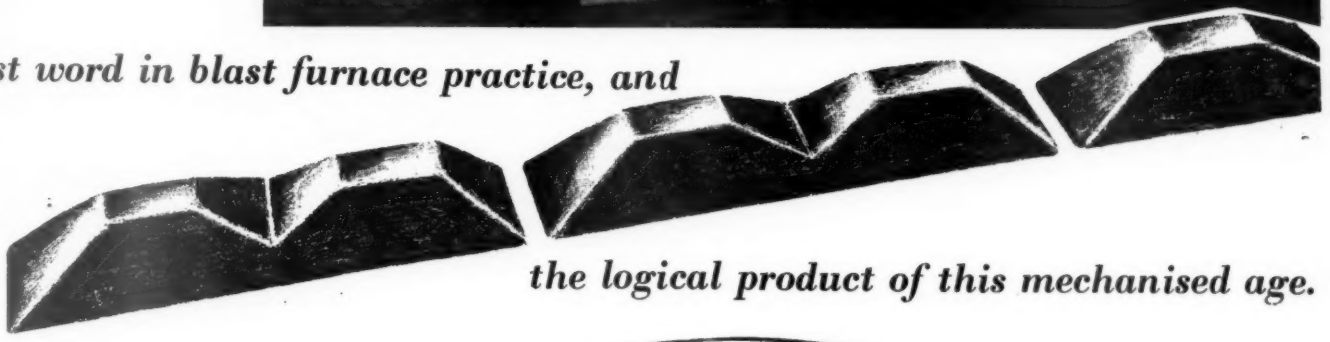
Iron-ore output of the Wabana mines of the Dominion Steel & Iron Corporation in the first eight months of 1941 totalled 651,933 long tons, compared with 981,956 tons during the same period of 1940. The decrease was due to the lack of shipping space, which caused the mine to operate only part time. Shipments during 1941 totalled 638,463 tons, compared with 694,301 tons for the 1940 period. In the 1941 period, 472,117 tons were sent to the company's plant at Sydney, Nova Scotia, 146,420 tons to Great Britain, and 19,925 tons to the United States. Total shipments in 1940 were 1,408,934 tons, against 1,404,001 tons in 1939 and 1,787,025 tons in 1937.

Spectrochemical Analysis Index

One thousand four hundred and sixty-seven references, representing a 50 per cent. increase over its first publication, are included in the second edition of the "Index to the Literature on Spectrochemical Analysis" recently issued by the American Society for Testing Materials. Its most recent additions cover improved descriptions of atomic spectra, studies of light sources and calibration processes, and conditions influencing the accuracy of quantitative determinations. All Papers in the index are arranged in chronological order, and in alphabetical order of authors in each calendar year. Copies may be obtained from the A.S.T.M. for $1.

STANTON

Last word in blast furnace practice, and



the logical product of this mechanised age.

ITS ADVANTAGES ARE MANIFEST

THERE IS NO SAND

THERE ARE NO SOWS

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THE STANTON IRONWORKS COMPANY LIMITED, Near NOTTINGHAM

American Metallurgical Scene—6

Grey Iron Foundry Practice*

BY JAMES T. MACKENZIE,

American Cast Iron Pipe Company, Birmingham, Ala.

The use of moulding machines reduces manual labour with consequent reduction of fatigue and allows rapid training of unskilled men as machine operators, thus easing shortage of skilled moulders. Mechanical handling of sand ensures uniform supply of well-mixed and well-tempered sand without necessity of skilled men and with practically no hard labour. This has an important effect in the reduction of losses and makes for easy cleaning. Conveyors handle moulds from machines to casting station and on to shake-out. Iron is mechanically handled too, thus reducing fatigue.

Core blowing machines are being used more and more, even for larger sizes of cores for heavy production schedules. Use of continuous automatically controlled core ovens gives better cores in a continuous and uniform flow. Increased attention is given to dust removal and atmospheric control, thus increasing comfort and efficiency of men.

Castings are being used to replace forgings, saving considerable weight and a great deal of machining. Many parts now being forged can be cast practically to size.

Pneumatic hammers for chipping and portable grinders have helped a great deal to cut time in the fettling shops and the hydraulic cleaning methods have shown pronounced benefits in removing cores while at the same time making possible the recovery of much core sand in excellent condition for use.

Storage facilities for raw materials in wagon-load lots with lift truck deliveries help to speed up production. Core rooms and fettling shops are working night shifts to keep up with production and the introduction of sand handling systems has enabled shops to go on extra hours or even to double shift.

Much ingenuity is being shown in rigging and utilisation of floor space. Moulds are stacked and overhead heaters are used for drying. Flasks are being standardised, thus speeding up production in slip and snap flasks. There is thus less equipment to handle, such as bottom boards, pouring jackets, etc., and this makes less delay on the part of the moulder waiting for such equipment.

With so much work to be done, no foundry should accept work which is not suitable for its particular moulding equipment, or requires special metal which it is not equipped to produce or with which its personnel is not familiar. A green sand foundry should not undertake work which should be made in dry sand, and it is not economical to make in dry sand castings that can be made perfectly well in green sand. Again, alloy cast irons in small tonnages cannot be made economically, due to the trouble of getting the value of the alloys in the returns—gates, sprues, and scrap. Alloy castings should be concentrated, as far as possible, from a conservation standpoint as much as from the skill and experience angle. Likewise, heavy castings are out of place in a light shop and vice versa.

Overtime Provisions in Steel Industry

An investigation carried out by the Industrial Relations Division of the United States Bureau of Labour Statistics throws light on the position in regard to provisions for overtime payments in agreements between employers and trade unions in the industries closely related to defence activities. The investigations revealed that in the basic iron and steel industry more than two-thirds of the workers are covered by agreements, whereas only about half of the fabricating employees are under agreement. Most of the agreements call for the 8-hr. day and the 40-hr. week, with the payment of time and a half for all overtime. Although only a few agreements require the payment of double time for all overtime, a considerable number require double time after 2 or 4 hrs. of overtime in any one day. Penalty payments for Saturday, Sunday and holiday work are common in the fabricating branch of the industry but rare in basic iron and steel (which, of course, require a great deal of continuous operation). More than a third of the fabricating agreements require time and a half for Saturday work. For work on Sundays and holidays, nearly half of the fabricating agreements establish the double-time rate, while the others provide time and a half. In about one-third of these cases regularly assigned employees, such as firemen and watchmen, are specifically excluded from the provisions.

New Acid Process for Aluminium

A new and economical method for making the United States self-sufficient in aluminium without consuming any of the nation's diminishing supply of vital defence ores was described by Prof. A. W. Hixson of Columbia University before the recent annual meeting of the American Institute of Chemical Engineers. Clay and other ores with a high silica content are utilised in the new process, instead of bauxite ores. The ores are roasted, then treated successively with hydrochloric acid and a selective organic solvent, such as isopropyl ether, both inexpensive by-products of the chemical and petroleum industries. The acid treatment facilitates the removal of the iron content by means of the selective solvent, leaving aluminium chloride. When heated, this compound becomes pure alumina, basic ingredient in the manufacture of metallic aluminium. Three major difficulties have prevented the successful application of an acid process in aluminium manufacture in the past, Prox. Hixson pointed out. These include the regeneration, or recovery, of the acid; the separation of iron from aluminium in an acid medium; and the necessity of employing materials of construction which can withstand the corrosive action of acid. All these difficulties are overcome by the new process.

1942 Cleveland Foundry and Allied Industries Show

A foundry and allied industries show is to be held in the Cleveland Auditorium and Exhibition Hall from April 18 to 24, 1942. The American Foundrymen's Association will hold its 46th Annual Convention in conjunction with the show. As an educational feature of the show, approximately 50,000 sq. ft. of space in the exhibition hall will be assigned to an exhibit of war equipment and materials and educational displays of the Army Ordnance and other Government departments. Co-operating in sponsoring the Ordnance display will be the Cleveland Post, Army Ordnance Association, working with C. E. Hoyt, Manager of Exhibits, and a special committee who will provide displays of all types of castings used in the national defence programme.

SALES OF FOUNDRY EQUIPMENT in the United States last October were a new record, according to the Foundry Equipment Manufacturers' Association. The October index was reported at 403.8, as compared with 363.8 in September and 377.2 in April, the latter being the previous 1941 record.

THE U.S. DEPARTMENT OF COMMERCE estimates that the value of machinery produced in the United States in 1941 reached a record high of $11,000,000,000, or $4,000,000,000 above the previous record established in 1929. The estimate applies to industrial, electrical, farm, printing and office machinery, but does not include automobiles, trucks, airplanes, ships, locomotives, railway or other transportation equipment.

NORTHWEST MAGNESITE COMPANY, Pittsburgh, has acquired rights in the United States to use the Chesny process of producing synthetic magnesite for refractory purposes. A plant will be built at Cape May Point, the first unit to have a capacity of 40,000 net tons annually. The Chesny process has been used on a large scale in Great Britain and has made her independent of natural magnesite formerly imported from Austria and Manchuria.

Patents and Designs Bill

The Patents and Designs Bill was read a second time in the House of Commons last week. CAPT. WATERHOUSE (Parliamentary Secretary to the Board of Trade) said it was a short measure to amend the Patents and Designs Acts, 1907 to 1939. It amended the Acts in three specific directions, each one of them necessitated by war conditions. Clause 1 dealt with the extension of the term of patents. Under the existing law an application for an extension must be made before the patent had expired, but it might well be that the patentee had been prevented by military service or by some other cause connected with the war from applying within the proper time. The courts were now given power to grant the extension on an application which would otherwise have been out of date. Again, under the existing law it was possible for only one extension to be granted by the courts. They now proposed to allow the courts to give a further extension in order to meet cases where, owing to war conditions, the patentee had not been able to reap the benefits he had a right to expect under his extension. Clause 2 gave fresh rights to the Government. It dealt with the use of patents and designs by Government Departments. Clause 3 was designed, like Clause 1, to safeguard the interests of the patentee. It dealt with inventions which, in the interests of national defence, had to be kept secret.

Obituary

MR. JOHN A. FLEMING, one of the original members of the firm of Fleming Bros., constructional engineers, Glasgow, died recently.

MR. WILLIAM JOSEPH THOMAS, late works manager at Cwmbran with Guest, Keen & Nettlefolds, Limited, died on January 14.

MR. JOHN SPENCE MATHIESON, director of Wilsons & Mathiesons, Limited, ironfounders, Armley, Leeds, died recently at the age of 47.

PRIVATE G. WILSON TUPHOLME, second son of Mr. G. E. Tupholme, managing director of George E. Tupholme & Company, Limited, dust extraction engineers and sheet metal workers, Sheffield, is now officially reported killed in action. He was reported missing in June, 1940.

MR. DAVID MARTIN died on Saturday, January 17, at his home in Glasgow. Well known in engineering, shipbuilding, and mining circles, he had been Scottish district manager for A. Reyrolle & Company, Limited, Hebburn-on-Tyne, for over 30 years. A native of Glasgow, Mr. Martin was 68 years of age.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

541,148 ROKTITE INDUSTRIES, LIMITED. Protective coating preparation for various substances such as metals, woods, concrete, brick, and asbestos.

541,176 THOMAS & COMPANY, LIMITED, R., and GRANT, W. K. Flying shears for cutting metal sheets.

541,193 BRITISH OXYGEN COMPANY, LIMITED, and WATTS, S. S. Process of and apparatus for dividing or desurfacing metal by use of an oxidising jet.

541,212 SOC. ANON. DES ETABLISSEMENTS P. BONVILLAIN & E. RONCERAY. Sand-rubbing machines.

541,240 BRITISH THOMSON-HOUSTON COMPANY, LIMITED. Coating of ferrous metals.

541,275 STEVENS, A. H. (Kane & Roach, Inc.). Rod and tube straightening machines.

541,312 BROOM & WADE, LIMITED, and ELWESS, E. Sand-blast and like cleaning apparatus.

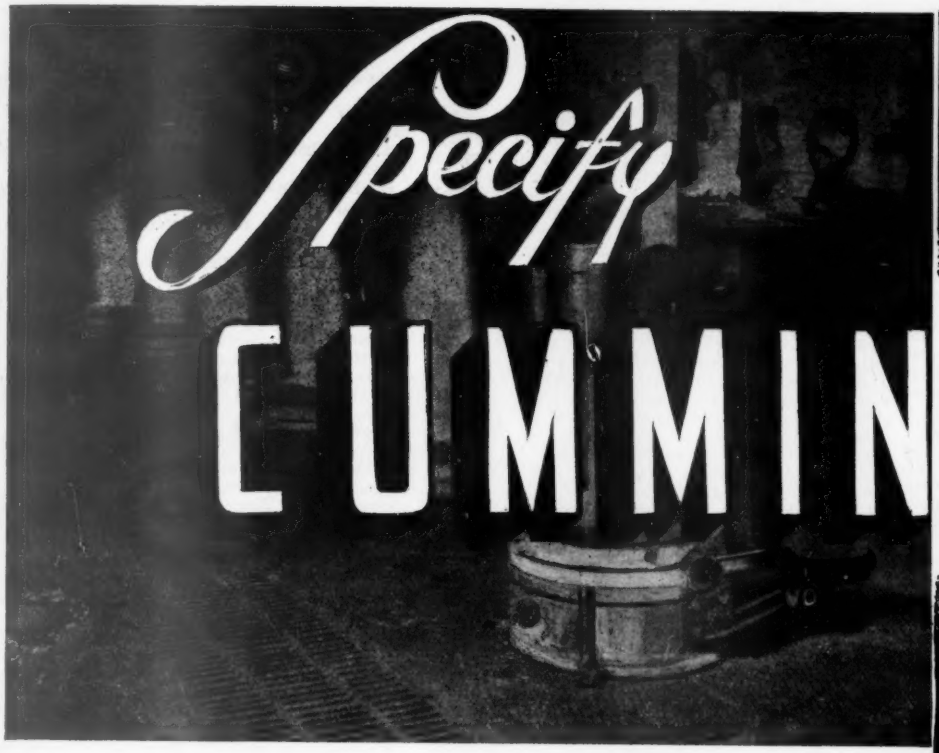
541,324 MOND NICKEL COMPANY, LIMITED. Castings made of nickel-copper alloys.

541,347 JAHN, A. R., JAHN, C., and LANCASTER, H. F. Electrolytic methods of oxidising the surface of nickel or nickel alloys.

541,404 BRITISH UNITED SHOE MACHINERY COMPANY, LIMITED (United Shoe Machinery Corporation). Heat-treatment of cast-iron or cast-iron alloys.

541,406 CHICAGO METAL HOSE CORPORATION. Methods of and apparatus for corrugating metal tubing.

* One of a series of short articles appearing in "Metals and Alloys," covering the general subject of speeding up munitions production.



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The Week's News in Brief

Trade Talk

THE SECRETARY of the recently-formed National Association of Non-ferrous Scrap Metal Merchants is Mr. John Hannaford, Aldwych House, W.C.2.

WARD & GOLDSTONE, LIMITED, manufacturing electrical engineers, celebrate their jubilee this year. The original company was founded in 1892.

AT JANUARY 1 the official cost-of-living index figure was 100 points above the level of July, 1914, compared with 101 points at December 1 last.

A MOBILE CANTEEN has been presented to the Glasgow W.V.S. by the Scottish Iron and Steel Scrap Association, which is the first organisation in the Iron and Steel Scrap Federation to present a mobile canteen.

PROF. GRANVILLE POOLE, of King's College, Newcastle-upon-Tyne, has suggested that the Government should help in the development of the North-East's mineral wealth. He states that the area is fairly rich in mineral deposits and that the output of fluorspar, lead and barytes could be increased.

LORD REITH, Minister of Works and Buildings, started the first of the county drives for scrap metal in the South-East of England last week, when he addressed a conference at Chelmsford. He announced that as part of the national campaign an Order would be made making compulsory the disclosure of all scrap metal.

THE NATIONAL FEDERATION of Scrap Iron and Steel Merchants has changed its name to the National Federation of Scrap Iron, Steel and Metal Merchants (and Allied Trades) and is organising separate Non-ferrous Sections for each of the Associations in the Federation. The Federation has also created a class of Associate member in order that membership may be open to the smaller dealer.

THE SOUTHERN RAILWAY COMPANY has completed construction of a new type of electric locomotive designed by Mr. Alfred Raworth, chief electrical engineer. It is designed for the operation of both freight and passenger services over the electrified lines of the Southern Railway. It can haul freight trains up to 1,000 tons in weight, and from a standing start can accelerate up to 24 m.p.h. in 100 secs. Drawing an express passenger train of 14 coaches, the locomotive is capable of a speed of 75 m.p.h.

SIR WALTER CITRINE, general secretary of the T.U.C., speaking at Glasgow on January 18, urged the appointment of a Minister of Production. He said that until they had a single Minister responsible for production, with all the departments of supply subordinate to him, they would never reach maximum production. He could see no evidence of a systematic review of production, though no doubt the Cabinet from time to time investigated certain phases of production. He urged a periodical survey of output by the Government.

THE MINISTRY OF LABOUR AND NATIONAL SERVICE publishes each month an illustrated journal, "Engineering Bulletin," which contains articles and up-to-date news of special interest to engineering firms engaged in war production. Its purpose is to assist managements by providing useful information on training new entrants, and making the best use of labour personnel, whether men or women. Every engineering firm which is not already receiving the monthly issue is recommended to write, stating how many copies are required, to the Director of Public Relations, Ministry of Labour and National Service, St. James's Square, London, S.W.1, when copies will be supplied each month free of cost.

THE FOLLOWING NAMES have been added to the list of members of the British Cast Iron Research Association; the name of the representative is given in parenthesis:—Thomas Blackburn & Sons, Limited, Bamber Bridge (Mr. James Sadler); Cannon Iron Foundries, Limited, Bilston (Mr. W. L. Johnston); Duport Foundries, Limited, Dudley Port (Mr. W. H. Plant); C. Ebeling & Sons Pty., Limited, Melbourne (Mr. J. D. Ebeling); Martin's Cultivator Company, Limited, Stamford (Mr. Trevor Mantle Jones); and Cylinder Components, Limited, Birmingham (Mr. G. Williams). The English Clays Lovering Pochin & Company, Limited, St. Austell (Mr. R. J. Davies) has joined as a trade member, and Mr. James Sanders, Wellingborough, as an associate member.

THE NORMAL TRAINING given in Government training centres has hitherto consisted of a course of four months or more in engineering trades. While those who were clearly incapable of profiting from the full course were placed in industry as soon as possible, the general aim was to develop to the full the capabilities of all persons entering training. It has been found from surveys of the work on which ex-trainees have been employed that a good proportion has not been required to make use of the full course. This was particularly so in the case of women. For this reason it has been decided to offer an initial course of from four to eight weeks to all trainees entering the centres and to give the full course normally lasting 16 weeks only to those trainees who are considered to be well suited to a more comprehensive course of training and capable of performing work requiring a considerable degree of skill. As a result of the experience of the working of the scheme, it has been decided that a concentration of effort can now be achieved, and it is proposed to close 15 Government training centres. It is considered that the facilities available in the remaining 24 centres will prove adequate for future needs.

Personal

MR. S. C. PARKER has been appointed a director of the Premier Metal Company of South Africa, Limited.

MR. H. E. BUSH, MR. W. C. MANDEVILLE and MR. R. TEMPLEMAN have been appointed directors of Engineering Components, Limited.

MR. R. W. TRENGOVE, manager of the Birmingham office of the British Aluminium Company, Limited, has retired. He started the Birmingham office more than 40 years ago.

MR. F. J. A. TOFT, who has been with Qualcast, Limited, for 22 years as secretary and cost accountant, and who has lately been acting on the board of their subsidiary, Follows & Bate, Limited, in Manchester, is returning to head office and has joined the board of Qualcast, Limited. MR. J. R. FLEMING, works director of Follows & Bate, Limited, has been appointed general works manager in charge of the production of the three Qualcast companies, and will make his headquarters at Derby. MR. D. MCMILLAN, assistant secretary at Qualcast Works, Derby, is going to Follows & Bate, Limited, as secretary.

Contracts Open

Bexleyheath, February 4—Sewer ironwork for the year ending March 31, 1943, for the Borough Council. The Borough Engineer, Council Offices, Bexleyheath, Kent.

Consett, February 7—Iron castings for the year ending March 31, 1943, for the Urban District Council. The Deputy Surveyor, Council Offices, Blackhill.

Gellygaer, February 7—Iron castings for the 12 months ending March 31, 1943, for the Urban District Council. Mr. John Evans, clerk, Council Offices, Hengoed, Glam.

Littleborough, February 9—Iron castings for the year ending March 31, 1943, for the Urban District Council. Mr. C. F. Wild, engineer, Council Offices, Littleborough.

London, S.E., February 4—Iron castings, etc., for the Southwark Borough Council. Mr. D. T. Griffiths, town clerk, Southwark Town Hall, Walworth Road, London, S.E.17.

Selby, February 16—Iron castings for the year ending March 31, 1943, for the Rural District Council. Mr. Richard F. Braithwaite, surveyor, 22, Park Street, Selby.

Swansea, February 5—Iron castings, iron and steel, lamp pillars (steel tubes), etc., for 12 months from April 1, for the Borough Council. The Borough Engineer, Guildhall, Swansea.

Truro, February 9—Iron castings during the year ending March 31, 1943, for the Cornwall County Council (Highways Department). The County Surveyor, County Hall, Truro.

Turton, February 24—Iron castings for the year ending March 31, 1943, for the Urban District Council. Mr. Reginald Dart, engineer, Council Offices, Bromley Cross, near Bolton.

Wilmslow, February 14—Iron castings during the 12 months commencing April 1, for the Urban District Council. Mr. A. A. Hamilton, surveyor, Council Offices, Wilmslow.

Reports and Dividends

(Figures in brackets refer to the previous financial year.)

Bensis Combustion—Interim dividend of 5% (same).

T. M. Birkett & Sons—Interim dividend of 5% (same).

R. B. Pullin—Final dividend of 15%, making 20% (same).

British Piston Ring—Interim dividend of 5% (same).

Greenwood & Batley—Interim dividend of 5% (same).

Allied Ironfounders (Ireland)—Net trading profit to June 30 last of £783 (£427), reducing the debit balance carried forward to £15,988.

Steel Corporation of Bengal—Interim dividend on the ordinary shares of six annas, free of Indian tax, being the first distribution on the ordinary shares.

Ley's Foundries & Engineering—Net profit, after tax, for the year to September 30 last, £53,200 (£65,384); dividend on the ordinary shares of 11% (same); forward, £49,102 (£39,484).

Electrolytic Zinc Company of Australasia—Dividend of 4% for the six months ended December 31, 1941, on the preference and old ordinary shares and 1% on the new ordinary shares.

Foster, Yates & Thom—Net profit for the year to September 30, 1941, £24,739 (£21,578); taxation, £10,000 (£12,000); dividend of 5% (same); to reserves, £8,500 (£2,500); forward, £1,818 (£1,579).

Kelsey-Hayes Wheel Company—Profit for the year ended August 31, after charging depreciation, taxation, and debenture interest, £21,299; dividend of 7%, free of tax, £21,144; forward, £108,141 (£107,986).

Westinghouse Brake & Signal—Net profit for the year to September 30 last, £141,629 (£159,781); to general reserve, £25,000 (£50,000); to staff pensions account, £10,000 (£5,000); to reserve for contingencies, £50,000 (£25,000); dividend of 10% (same); forward, £91,273 (£92,384).

J. Samuel White & Company—Profit for the year to September 30, 1941, after depreciation and taxation, £55,494 (£58,185); war damage contributions, £7,533; to general reserve, £25,000 (same); final ordinary dividend of 7½%, making 12½% (same); forward, £19,443 (£19,547).

Lake & Elliot—Profit to July 31 last, after depreciation, war risk insurance and taxation, £29,086 (£41,246 after taxes); staff pensions, £2,154; preference redemption, £2,596; 6% preference dividend, £1,904; dividend on 7% redeemable preference shares, £6,784; ordinary interim dividend of 5% (40%), £2,500; final dividend of 15% (60%), making 20% on £50,000 (100% on £20,000); forward, £45,855 (£41,308).

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Wolverhampton Iron Founders (1941), Berrington Chambers, 93, Tettenhall Road, Wolverhampton—£1,000.

Sidcup Tool & Gauge Company—£2,000. W. G. Percy, 23, Slaithwaite Road, London, S.E.13, and J. Percy.

Sims Tool & Engineering Company—£5,000. C. Aukin, 116, Fenchurch Street, London, E.C.3, subscriber.

Adam Steel, The Poplars, Wallaton Road, Beeston, Notts—Engineers, etc. £2,000. M. V. C. and I. H. Boudard.

Eland Engineering Company, St. John's Road, Hampton Wick, Kingston-on-Thames, Surrey—£2,000. J. J. and E. W. Lane.

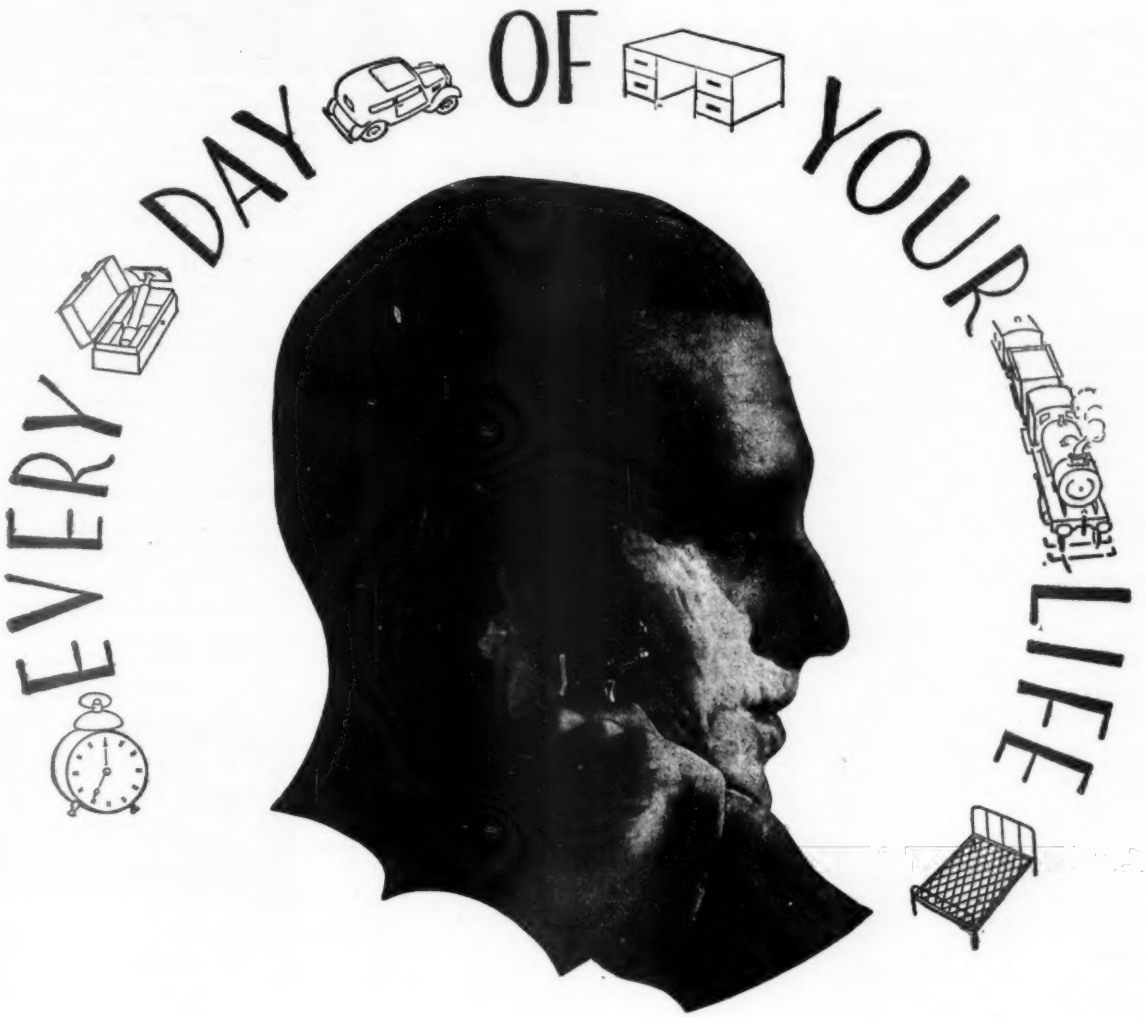
Barracuda, 222, Arundel Street, Portsmouth—Engineers, ironfounders, toolmakers, etc. £10,000. H. H. Bullock and R. C. Bewsher.

George Wheaton, 14a, Leytonstone Road, London, E.15—Engineers, tool makers, etc. £2,500. G. M. K. Wheaton, F. G. Sage, and J. W. G. Hunt.

Elliott Engineering—£2,000. J. W. J. Elliott, Leeswood Old Hall, Mold, Flint; R. M. and J. B. Duckworth, K. E. Nicholson and P. B. McAlpine.

Anthonite—Electrical, mechanical and general engineers. £5,000. R. Amberton, Lavender Lodge, Laleham, Middx; W. O. Jackson, A. R. and M. Amberton.

B. Earnshaw & Company, Railway Works, Crosland Moor Bottom, Huddersfield—Ironfounders, engineers, etc. £2,000. H., F., and W. A. Earnshaw.



... BEGINS AND ENDS WITH REFRACTORIES

THE WHIRR of an alarm clock, a smooth shave, the rumble of a train or the swish of a car are a few commonplace occurrences which should remind men that all the productions of the modern world are the creations of HEAT—harnessed and controlled by Refractories. Naturally the selection of suitable refractories is important because refractories decide the life as well as the output or efficiency of all industrial furnaces. Wherever plates and sections, castings and forgings, power and light are produced or generated: in iron, steel and alloy plants, in the glass and ceramic trades: in the cement and chemical industries: wherever men use Heat—there you will find General Refractories products.

G.R.38

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Raw Material Markets

Foundries engaged upon business for Government departments are assured of a steady flow of deliveries of iron under licence. Heavy engineering castings are in great demand, and makers' order-books are completely filled over some time to come. Producers of light castings, on the other hand, are, generally speaking, in need of additional employment, and would welcome the acquisition of contracts for the Government. Unfortunately, these are not likely to be forthcoming on any scale, as most of these works are unable to cope with the type of castings required for the war effort.

Pig-Iron

MIDDLESBROUGH—Shipbuilders and armament factories generally are in the market for very considerable quantities of heavy castings, and local makers are fully occupied in dealing with these orders. Practically the entire ironmaking capacity of the North-East Coast area has been given over to the production of basic iron and hematite, production of Cleveland foundry iron being intermittent and of small dimensions. At present, adequate tonnages of ordinary foundry iron are coming forward from the Midlands, so that the loss of the local output has not seriously inconvenienced users. Business in the light-castings branch is still at a fairly low ebb, with but dim prospects of any material improvement.

LANCASHIRE—Activity among heavy foundries in this district is maintained, and there is plenty of work offering in this branch. Deliveries of pig-iron are quite satisfactory on the whole, but supplies of hematite are not obtainable except for work of high priority, and even then only if a suitable alternative cannot be found. Refined irons are being used extensively in place of hematite, while a certain amount of Scottish foundry iron is also being absorbed, although there is not much of this type of iron to spare.

MIDLANDS—Machine-tool manufacturers and heavy engineering foundries are busily employed in meeting the demands of Government departments, and replacement orders are coming regularly to hand, so that continuous operations are assured. Quite a fair volume of business of an important nature is also being allocated to jobbing foundries, so that, in the aggregate, consumption of low-phosphorus and refined irons is substantial. Consumers naturally would be pleased to obtain larger quantities of hematite, but this is not possible, as this type of iron is reserved exclusively to meet the needs of users who cannot make do with other grades and who are employed on contracts of special importance. Demand for high-phosphorus iron is not very brisk, although heavy foundries are taking up much larger quantities than is usually the case in this branch.

SCOTLAND—There is a keen demand for low-phosphorus iron, and current outputs are barely sufficient to cover requirements. The needs of firms operating on high-priority contracts are, of course, receiving special attention in order that working may continue without interruption. Stocks are about non-existent both at consuming and producing works, and the situation cannot be entirely satisfactory until reserves have been replenished. There is ample high-phosphorus iron available for the light-castings trade.

Coke

In recent weeks a number of buyers of foundry coke have been forced to make inroads into their stocks, as fresh deliveries have been delayed. Transport conditions are still slightly below normal, but few consumers are inconvenienced, ample supplies being held in reserve. The price of 62s. 9d. per ton for Durham best foundry coke, delivered Birmingham and Black Country stations, remains in operation and is subject to a rise-and-fall clause.

Steel

Home production of steel is being stepped up to the utmost limits. It is not now possible to supplement home outputs by imports from the United States on any appreciable scale, although American shipments are continuing to arrive at United Kingdom ports. Special attention is being concentrated on the production of alloy steels, and gratifying results are being achieved. High-grade qualities are very important in connection with the manufacture of armaments, and still larger tonnages will be required to cope with the demands of the munitions programme this year. Plates are in very strong request, while the call for sheets, joists and sections is tending to improve.

Scrap

Steel furnaces are making very insistent demands for scrap, and additional supplies are necessary to keep the furnaces in full production. It is as yet too early to assess the results of the new collection scheme, but the importance of this campaign cannot be too strongly emphasised. Current needs are being dealt with satisfactorily on the whole, but buyers are in the market for all the material they can procure.

Metals

COPPER—With the continuous expansion of production of war materials, every effort is being made to keep copper-using works well supplied, and the authorities are, in the main, achieving this task very successfully. Non-essential supplies have been cut to the bone, not so much because of any shortage of metal, as to ensure that vital consumers do not go short now or in the future.

TIN—Further developments have occurred in the negotiations between the Ministry of Supply and the London Metal Exchange, but no common basis for agreement has been attained. The Exchange has refused the Ministry's suggested price of £259 10s. per ton for tin requisitioned under the Order dated December 9 last, and, in view of this, the Ministry has announced that it is willing to accept the position that default of agreement as to amount has arisen, and that the provisions of Section 7 of the Compensation (Defence) Act, 1939, should operate. Consequently, the Ministry will take the matter to arbitration. It is understood that the price for requisitioned tin asked for by the Exchange is £265 per ton. According to a report from New York, steps are being taken by the U.S. Government to increase the capacity of the tin smelter under erection at Texas City by 5,000 tons to 25,000 tons of tin per annum.

SPELTER—Zinc is playing an ever more important part in the war production of the nation, but despite the big increase in consumption during the past year, supplies are reaching consuming points satisfactorily. That this is so is due largely to the elimination of non-essential uses of the metal. Statistics of the American zinc industry for 1941 indicate that output reached its maximum in the last month of the year, when 78,635 short tons was produced, the total for the twelve months being 863,609 tons, against 706,100 tons in 1940. Deliveries over the year were 857,218 (762,780) tons.

LEAD—Demand for lead has not risen so steeply as that for other non-ferrous metals since hostilities broke out, and it is doubtful if consumption at the present time is equal to that of pre-war days when trade was good. Nevertheless, demand from battery and cable makers, etc., is very strong.

Non-Ferrous Scrap Prices

Prices for process and manufacturing scrap for the week ending January 24 are unchanged.

No. 5
STEELMOL
(THE LATEST CORE AND MOULD WASH)
FOR
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